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E.D.A. and the Future

Survival after Electricity Reorganization

WHEN the Electrical Development Association began its career about twenty-six years ago its undisguised object was to persuade people to use more and more electricity, it might almost be said without regard to the consequences. Soon it became clear that this was not the best policy. While the extended sales of electricity enabled the price to be reduced, indiscriminate use still resulted in big bills and odious comparisons with the cost of gas. The fact was that electricity was too easy to use. The Association saw that the education of consumers was more important than the reiterated exhortation to " Use More Electricity." It was at this point that E.D.A.'s real service to the community began; it was converted from a purely propagandist body to a constructive one.

Proved in Wartime

When war came and with it the urgent need for fuel conservation it seemed as though an association instituted to encourage the greater use of electricity had become superfluous. It was thought, erroneously, that E.D.A. would either have to lie moribund or " go into reverse " and actively discourage the use of electricity, thereby finding itself in a somewhat ridiculous position. This would certainly have been the case if its character had not changed or perhaps " developed " is the more appropriate word.

As it was, all the Association had to do was to strengthen that side of its propaganda designed to encourage the proper use of electricity. As electrical methods, properly applied, are the least wasteful of fuel this represented a logical continuance of its ordinary functions. Its usefulness in this respect was fully recognized by the Ministry of Fuel and Power, and other Government Departments (notably the Ministry of Food) also found that E.D.A. could be used in the national interest as an educator of the public. Thus throughout the war the Association with attenuated staff and smaller income found itself with about as much propaganda work on hand as it had in peacetime.

Technical Activities

At the same time the technical side of its activities was continued with much vigour and in many directions. There has been questioning from some quarters as to the propriety of the Association's indulgence in anything but constant repetition of the " Use More Electricity " slogan. We believe that these questioners now form a very tiny and still diminishing minority—a minority which is certainly not right. It is the educational and technical work of the Association which is likely to ensure its continuance in the coming reorganization, particularly if there is any sort of " co-ordination " of fuel services. For the electrical industry it is important that E.D.A. shall survive to maintain electricity's rightful place in any co-ordination move. Any frustration of electricity supply would have most unfortunate effects upon the electrical manufacturing industry, more particularly as regards its ability to compete in overseas markets.

The people have shown their preference for electricity and it has become axiomatic that industrial survival depends upon greater electrification. Whatever shape the electricity supply industry may take in the future it seems to us that some sort of organization will always be needed to open up new fields, to suggest, assist and encourage research into electrical applications, and to promote the intelligent and efficient use of electricity. It would be unwise of the Government not to recognize this and not to make full use of an existing body which has justified its existence so well.

Nationalization Debated

IT cannot be said that any new arguments for or against nationalization of the electricity supply industry emerged from the Commons Debate on the Address. Speakers on the Government side reiterated their opinion (impossible to prove before the event) that public ownership would effect remarkable improvements. The Opposition speakers appeared to be handicapped by the same inability to foresee the outcome, although they emphasized the untimeliness of such a measure. They were also unable to deny responsibility for the 1926 Act and the Central Electricity Board, to which were added pro-nationalization sentiments expressed in a Conservative report freely quoted from by Mr. Morrison. The debate got us nowhere. Nothing practical can be expected until the Government introduces its Bill, when the Opposition must do its best to remove or soften undesirable features which are almost certain to be included.

Industrial Tariffs

PROBABLY the most disturbing question raised in the report of the Power Companies summarized in this issue is the one dealing with the effect on industrial electrification of standardizing prices throughout the country. Costs vary greatly with local conditions and, owing to their specialized knowledge, supply undertakings can nearly always offer advantages over private plants, which tend to restrict electrical expansion. If lower costs in favourably situated areas are merged in the national total, the ability of public supply to compete with private plants, which are likely to continue to enjoy local advantages, will be seriously prejudiced.

Generation and Distribution

THE complex nature of the connection between generation and transmission on the one hand and distribution on the other as it affects consumers is a matter of practical experience. The Power Companies' statement, however, that the separation of the two functions was never advocated by any Parliamentary Committee, is likely to be questioned. Although not inherently on all fours with the present argument, the Weir Report of 1926 differentiated between the two, pointing out that detailed distribution was essentially a local matter. Perhaps if Section 13 of the Act of 1926 had had a reasonable time limit and hypothetical costs of generation (twenty years later) had not come to be regarded as a subject for derisory comment by the public, the need for the present report would not have arisen.

Yet Another !

THOSE who thought that the spate of reports on electricity distribution had stopped were wrong for, in addition to the Power Companies' statement referred to above, the Conservative Central Office has also produced a booklet on the subject. Broadly speaking this does not go far beyond the McGowan Committee's proposals to which it generally subscribes, including the recommendation (not however mentioned in the summary) that retained undertakings should be given a minimum period of security of tenure.

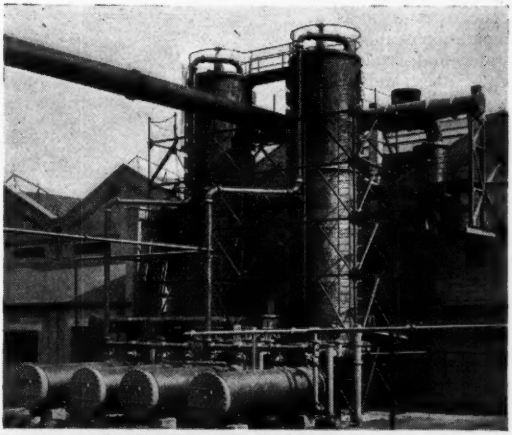
Export Progress

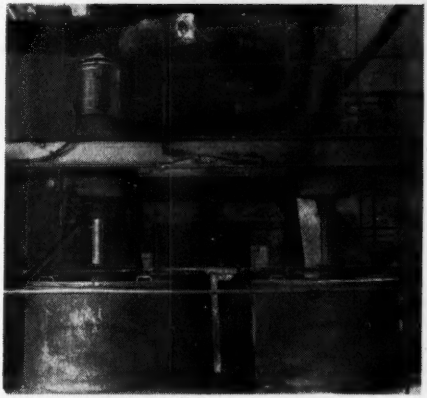
LAST month exports of electrical goods, apparatus and machinery from this country reached the phenomenal figure of over £5½ million—over three times the monthly average for 1938. As we show in the survey of the figures in this issue, the increase was well spread over all items, although machinery exports did not advance to the same extent as those of goods and apparatus. In view of our own needs in this respect this was only to be expected. It is remarkable that while in the export list radio equipment loomed large, imports of that class were extraordinarily high. They came from Canada and were evidently of a special nature. We have been told by B.E.A.M.A. that the industry's export "target" should be £65 million annually; in October that rate was exceeded.

Shale By-Products

Making Sulphate of Ammonia, Bricks and Candles

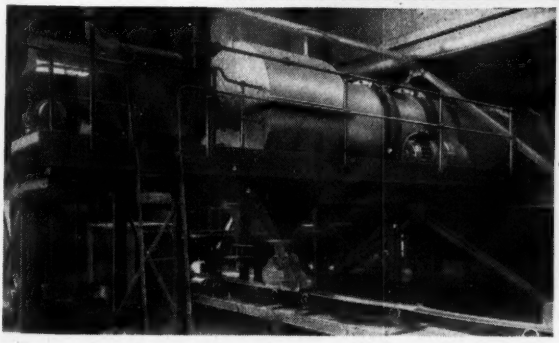
ARTICLES recently published in the *Electrical Review* have dealt with the electrical applications in the major processes involved in the production of shale oil by Scottish Oils, Ltd., from the actual winning of the oil-bearing shale to the refining of the finished products. These extensive operations, however, do not complete the work associated with the shale-oil industry, for certain by-products are "released" by the major processes, and these constitute the raw materials for additional products. These materials are ammonia water, a by-product of the crude-oil works and the refinery, from which is produced sulphate of ammonia; wax, a by-product of the refinery from which candles are made; and the spent shale from the crude-oil works retorts which has been mainly a waste material but now is used as a basic material for manufacturing bricks.





Ammonia water is pumped to the ammonia stills at the rear by way of the horizontal pre-heaters in the foreground. Moisture in the sulphate of ammonia crystals is driven out in motor-driven centrifuges (left)

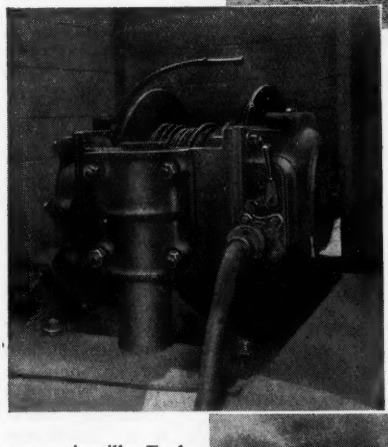
Dealing first of all with sulphate of ammonia, at the Westwood crude-oil works there is an installation capable of producing 45 tons of ammonia per day from 320,000 gal. of ammonia liquor. Essentially the process involves liberating the ammonia from the water, combining it with sulphuric acid, collecting the ammonium sulphate so formed, and



Crystals are finally treated in horizontal rotary-type driers

finally washing and drying the product. After the vapours from the retorts have passed through the condensers there is a separation of ammonia water and crude oil, and the ammonia water produced as the result of absorption in the water scrubbers is collected in stock tanks.

The ammonia water so collected is pumped to the ammonia stills by way of heat interchangers or preheaters in which the heating medium is hot spent water which has been distilled in the ammonia stills. Each of the four horizontal cylindrical preheaters contains 206 2-in. tubes, about 15 ft long. The heating water circulates through these and the ammonia liquor is passed through the shell space outside the tubes, which is baffled in order to form four passes. The ammonia stills are heated by means of steam at 10 lb per sq in. derived from the pass-out stages of the steam turbines in the power station. The still is essentially a tower which is equipped internally with fourteen trays, fitted with bubble cups, the trays being spaced at 24-in. centres up the tower. The ammonia liquor, which contains ammonia equivalent to about 0·4 lb of sulphate of ammonia per gal., is fed into the still at the top.



Spent shale is brought up out of an old bing by a single rope haulage system served by equipment with the motor incorporated in the rope drum (left)

As the ammonia water flows down the still it meets an ascending current of steam which absorbs the ammonia; this results in a mixture of steam and ammonia to be dealt with in subsequent processes. It contains, however, a proportion of "fixed" ammonia in the form of salts which are decomposed by treatment with milk of lime prepared in a motor-driven lime mixer.

Lime is chute fed to a crusher

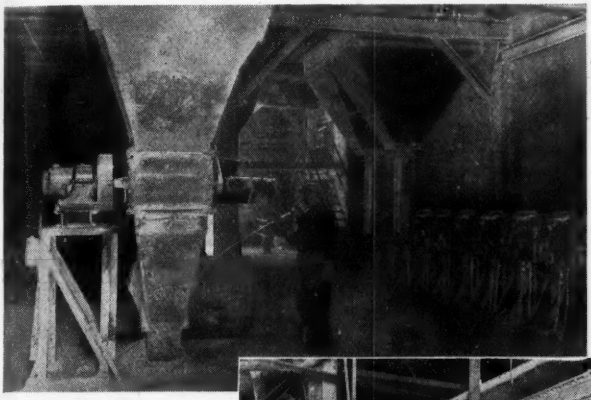
The steam-ammonia mixture is passed on to lead and brick lined saturators in which it is treated with sulphuric acid to form sulphate

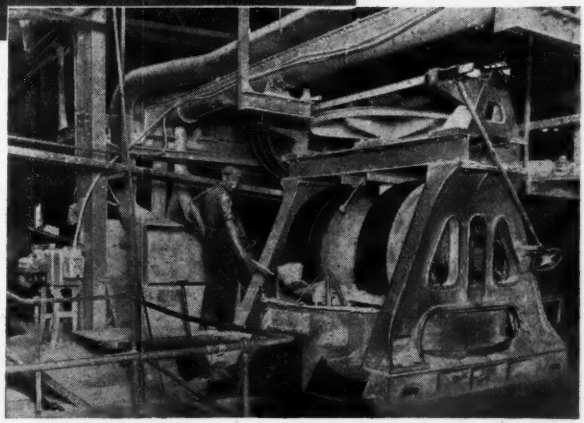
of ammonia crystals. These settle in a well in the bottom of the saturator, from which they are transferred by steam ejectors to a draining table. They contain a fair amount of moisture, most of which is driven out in centrifugal driers of the type used in the sugar industry. These centrifuges are about 42 in. in diameter, and in each case the revolving inner container is directly connected to a 12-H.P. overhead vertical-spindle motor running at 750 r.p.m.

The crystals are finally treated in two horizontal rotary type driers in which steam-heated air flows against the flow of the sulphate. Each drier is about 4 ft in diameter and 20 ft long, and is equipped inside with longitudinal rows of blades by which the sulphate is passed along the cylinder. The air is passed through the drier by an external fan capable of delivering 2,200 cu ft per min and directly driven by a 1½-H.P. motor. The drier itself is rotated at about 6 r.p.m. by a 5-H.P., 725-r.p.m. motor which transmits first through an enclosed reduction gear from which a pinion wheel engages a rack round the periphery of the drum.

A belt conveyor receives the dried crystals from the rotary drier and delivers them by bucket elevator to an overhead bunker from which they are fed to a motorized bagging and weighing machine. A special conveyor then delivers the bags to a motor-driven sewing machine which closes the ends of the bags before they are passed on to a storage house in which they are stacked 18 ft high and which has a capacity of 2,500 tons. This room is air conditioned, so that the sulphate is stored constantly in air at 65 deg F.

It will be appreciated that one of the most important electrical applications to the above processes relates to the conveyance in the earlier stages of the liquids to and from the stills and other plant components, which involves considerable pumping operations. These are provided for by the central products pump house described and illustrated in the article on the Westwood crude-oil works (*Electrical Review*, August 23rd, 1946). The sulphate-of-ammonia plant is essentially and inherently part of the Westwood Works, particularly from the point of view of services.



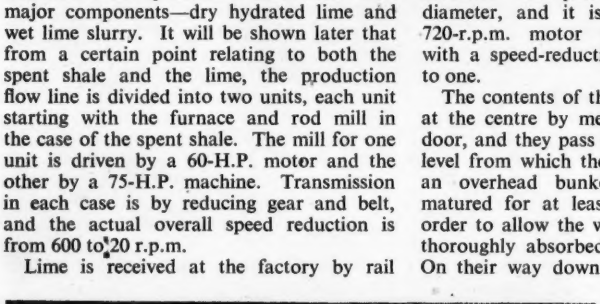


Above: On their way down from the stirring pan the materials pass through a motor-driven feeder which regulates the rate of feed to the elevator; factory distribution switchgear in rear. Right: Hydrated lime, slurry [and spent shale all meet and are mixed in the pan mill

Bricks are made at a factory adjoining the Pumpherston Oil Refinery where the spent shale is brought up out of an old bing by a single-rope haulage system served by an Austin Hopkinson unit with its 15-H.P., 1,500-r.p.m. driving motor incorporated inside the rope drum. The starting switch is also built into the haulage unit, and a trailing cable supplies this from a Metrovick main switch. The tubs of spent shale from the bing are tipped into a hopper for delivery through a coal-fired drier furnace to a rod mill in which it is ground ready for feeding to the appropriate part of the flow line where the spent shale meets the other major components—dry hydrated lime and wet lime slurry. It will be shown later that from a certain point relating to both the spent shale and the lime, the production flow line is divided into two units, each unit starting with the furnace and rod mill in the case of the spent shale. The mill for one unit is driven by a 60-H.P. motor and the other by a 75-H.P. machine. Transmission in each case is by reducing gear and belt, and the actual overall speed reduction is from 600 to 20 r.p.m.

The moulding machine and the pan mill and associated conveyors constitute a production unit with a group drive

Lime is received at the factory by rail and is first chute fed to a rotary sledge-hammer crusher which reduces it to powder. The crusher is driven by a 15-H.P. 1,440-r.p.m. motor with transmission by belting, with an overall speed-reduction ratio of 1·44 to one. The crushed lime is then delivered by a bucket elevator to an overhead bunker from which it is fed down as required into a stirring pan in which it is hydrated by means of sprays as the horizontal pan slowly revolves. The pan is about 10 ft 6 in. in diameter, and it is driven by a 10-H.P., 720-r.p.m. motor with belt transmission with a speed-reduction ratio of about four to one.



Bricks are " baked " in steam-heated ovens

The contents of the pan are ploughed out at the centre by means of a cylindrical lift door, and they pass down a chute to ground level from which they are again elevated to an overhead bunker in which they are matured for at least twenty-four hours in order to allow the water of hydration to be thoroughly absorbed by the hydrated lime. On their way down from the stirring pan, the materials pass through a motor-driven roll feeder which regulates the rate of feed to the elevator. After maturing, the hydrated lime is removed from the bunker by a screw conveyor and is chute fed to a separator which rejects all material not of powder fineness. The fan for the separating action is a 34-in. diameter single-stage type, directly driven by a 15-H.P. 1,440-r.p.m. motor; it passes the hydrated lime into storage bunkers, where it awaits transit to the brickworks via a screw conveyor. Large rejects from the separator are

returned to a raw lime crusher for reprocessing. The separator is driven by a 12-H.P. motor with three-to-one ratio V-belt transmission.

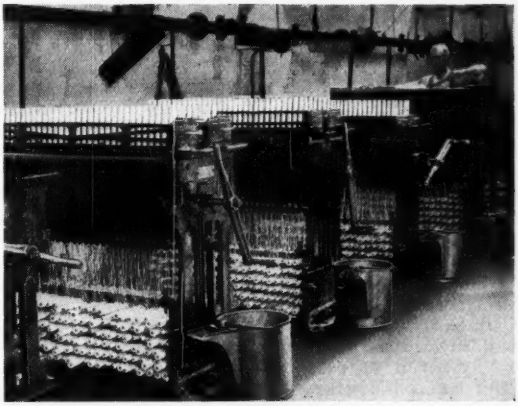
The hydrated lime, delivered by conveyor from the storage bunkers; the slurry, delivered by inclined trough from the slurry mixing vats; and the spent shale, delivered by conveyor from the rod mill, all meet and are mixed in the pan mill. A vital point is the correct proportioning of the materials fed into the mill and the precise regulation of the quantity of lime introduced as wet slurry in order to obtain the correct plasticity.

The pan mill has two vertically-disposed revolving wheels with their peripheral faces bearing on the inside of the horizontal revolving pan or container. The mixture from the mill is passed on by a belt conveyor to a brick-moulding machine in which the wet bricks are formed in moulds recessed in the top surface of a horizontal revolving table. At the appropriate point in its journey round the table each brick is ejected from its mould, to be picked up by hand and loaded on to a trolley for conveyance to autoclaves or steam-heated ovens in which the bricks are subjected to superheated steam for eight or nine hours. This is equivalent to the "baking" in the brickfield kilns.

We have already indicated that for the later processes the production flow line is divided into two units, each embracing its own pan mill and moulding machine and the associated conveyors. This group of machinery in each case constitutes a group drive with about three-to-one reduced transmission from the floor-mounted motor to a main overhead line shaft from which there are secondary belt transmissions to the machine pulleys. The two production units are capable of turning out 3,000 bricks each per hour.

The production of candles from the wax from the oil refinery is carried out at the Broxburn candle factory where the slabs of wax are first melted in steam-heated vats. The molten wax thus obtained is poured into vertical candle moulds of the candle-making machines via a trough or bath at the top of the moulds which constitutes a common feed to the moulds. There are from 100 to 360 moulds per machine, and the feeding bath or trough measures about 9 in. wide by about 6 ft long. Through each mould is held a centrally disposed wick around which the molten wax settles and finally solidifies.

The moulds are encased in an outer shell, so that the assembly is rather like that of a vertical tubular condenser, and solidification is accelerated by passing cooling water through the jacket. This water circulation by motor-driven pumps represents the only electrical application to the very simple sequence of processes. After solidification the bottoms of the candles are sheared, and the candles are ejected upwards *en bloc* by means of rods projecting from a framework which is moved by pinion and rack gear on the end of the machine. The ejected candles remain in a "cage" immediately above the moulds until the next lot of candles is solidified, thus retaining the wicks in the correct positions. After cutting of the wicks the "caged" candles are removed from the machine and are ready for packing.



Candle-making machines

The company has good reasons to be proud of its welfare services, in connection with which there are also electrical applications such as the electric cooking installations in the canteens and air-conditioning plants in the workmen's baths at the various works.

We are indebted to Mr. R. Crichton, managing director, Scottish Oils, Ltd., for permission to visit the works, and to Mr. G. A. McLennan, chief electrical engineer, and Mr. W. Stirling, assistant electrical engineer, for help in preparing this article.

Views on the News

Reflections on Current Topics

TIME maintains its proverbial equivalence to money in that one can usually do much less with a given amount of it nowadays. This is mainly *apropos* of Mr. J. F. Shipley's request to members of the I.E.E. Installations Section to be more forthcoming in the submission of papers. At one time a paper could be put through in about three months; this period was gradually inflated to six to nine months, and now twelve to eighteen months is required. That means preparing the programme for two sessions ahead. Considering the wide field covered by the Section's activities and the knowledge acquired by its members of new processes and machines, there should be no lack of subjects. These papers need only be short ones, thus providing some kind of a link with the proposed "discussion meetings" for the "under thirties."

* * *

As things have turned out, it is a pity that so little encouragement was given in better days to the thermal-storage cooker and heater. These were always good load levellers but I suppose however much favour they secured from supply engineers, the general public was disinclined to embark upon the unorthodox methods which they seemed to demand. Now possessors of such appliances, if there are any, can remain unperturbed by sudden load shedding—apart from the loss of light if it happens in the dark hours. This last consideration suggests an opening for luminescent as well as fluorescent tubes.

* * *

Whatever may be the case in other branches of industry, during my recent visits to electrical factories I have been unable to detect any very serious slackening of productive effort on the part of the operatives. Admittedly there is not the same atmosphere of urgency as there was during the critical days of the war, but it is mainly causes outside the scope of the worker which prevent expansion of production of peacetime goods from attaining the impetus hoped for. Almost always difficulties can be attributed to shortages of materials. These shortages are particularly noticeable in sheet steel and aluminium ceramics, motors, switchgear, installation accessories and thermostats, and many manufacturers are having to make arrangements to manufacture everything in order to become self-supporting: they feel that if they are to hope to maintain a steady and increasing output they cannot rely on present insufficient and spasmodic deliveries. To these shortages of materials are traceable almost all of the very few cases encountered of "going slow" on the part of the operatives, who, foreseeing a possibility of being "laid off" when they have used up all the materials available, not unnaturally feel disinclined to hurry.

* * *

Last week's announcement by the Southern Railway of its intention to extend its colour-light signalling to further tracks is good news for people who use those lines. Apart from its undoubted usefulness to traffic it brings a little comfort to a light-starved people. Waiting on a Southern station, like most stations dreary and open to all the winds of heaven, the passenger is beguiled by the ever-changing constellations of red, green and amber with streamers formed by the polished rails—much more tasteful than the peacetime Piccadilly Circus.

* * *

I have referred on previous occasions to the many bewildering qualifications represented by sometimes unfamiliar initials. A correspondent has asked for enlightenment in connection with a number of these. Some I recognize but "B.B.A." has baffled me. I hope I will not be offending some august organization by asking what the letters stand for. Once again I must put in a mild protest against this Pickwickian use of the alphabet.

* * *

The approach of the Christmas season revives the question "What shall I give?" In a list which it is circulating E.D.A. makes a number of suggestions which will solve this annual problem. In these days of coupons people are turning more to gifts which are free from such restrictions and small domestic electrical appliances, which are in good supply, and moderately priced, make the selection a comparatively easy task. To the housewife who keeps fuel economy in mind, E.D.A. stresses that there are a number of appliances in which the current consumption is very low.

—REFLECTOR.

Energy Export and Import

Use of the Four-Quadrant Vector Diagram

By A. Salzmann, A.M.I.E.E.

BY linking two power stations, A and B, power can be dispatched in both directions at will. In Fig. 1 the in-phase current $I_c \cos \phi_c$ and the reactive current $I_c \sin \phi_c$

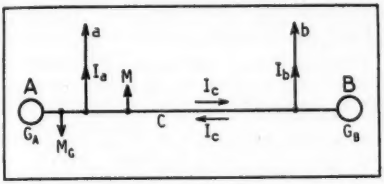


Fig. 1.—Interconnection of two power stations, A and B, working in parallel (a and b, load at lagging power factor)

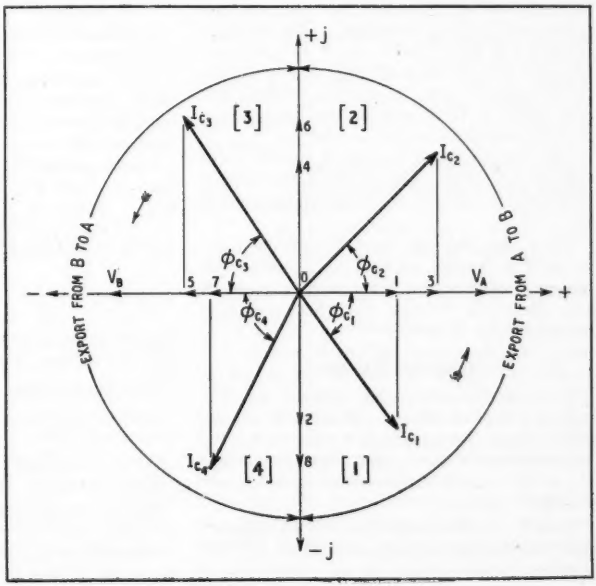
in the interconnector C will flow from A to B and vice versa. There are other alternatives. The direction $I_c \cos \phi_c$ is from A to B and $I_c \sin \phi_c$ from B to A, or the in-phase current flows from B to A and the wattless current from A to B. This is shown in the four-quadrant vector diagram (Fig. 2).

Assume the voltage on the busbar A and B is equal, $V_A = V_B$, the impedance Z_c of the interconnector C is negligible, the power generated by the alternators G_A and G_B is equal, and the steam supply to each prime mover remains unchanged. We have to distinguish four cases.

Fig. 2.—Four-quadrant vector diagram for current Ic

Case 1. — Inductive load b is greater than load a. Field of alternator G_A is excited so that generated current I_A lags behind the terminal voltage V_A at p.f. cos ϕ_A. The excitation of G_B must be so adjusted that the machine operates at p.f. cos ϕ_B = cos ϕ_A lagging. The in-phase and reactive current in the interconnector will flow from A to B. The total current I_{c1} lags behind the voltage V_A at p.f. cos ϕ_{c1}. Assuming V_A is the reference vector, the current vector I_{c1} lies in quadrant (1) (270 to 360 deg). The power is represented by $\overline{01}$, the reactive power by $\overline{02}$ and lags behind the voltage V_A.

Case 2.—Inductive load b is greater than load a. Field of alternator G_A is excited so that armature current I_A is in phase with the terminal voltage V_A. The excitation of G_B must be so adjusted that the machine operates at p.f. cos ϕ_B lagging. The in-phase current in the interconnector will flow from A to B, delivering the additional current for consuming area b, but the reactive current will flow from B to A as the alternator G_B must supply the wattless power for the inductive load a. The current vector I_{c2} lies in the quadrant (2) (0 to 90 deg). The power is represented by



$\overline{03}$, the reactive power by $\overline{04}$ leading the voltage V_A.

Case 3.—Inductive load a is greater than load b. Field of alternator G_A is excited so that the armature current I_A is in phase with the terminal voltage V_A. The excitation of G_B must be so adjusted that the machine operates at p.f. cos ϕ_B lagging. The in-phase and reactive current in the interconnector will flow from B to A, as G_B must supply the additional power and the total reactive power for supply area a.

The total current I_{c3} must be referred to the voltage V_B equal and opposite to V_A and not to the voltage V_A. This is a very important point and is similar to the connection of two batteries in parallel.

The current vector I_{c3} lies in quadrant (3) (90 to 180 deg). The power is represented by $\overline{05}$, reactive power by $\overline{06}$ lagging the voltage V_B.

The reactive current flowing from B to A is leading referred to V_A when the power is delivered from station A to B and lags behind the voltage V_B when the power is transmitted from B to A.

Case 4.—Inductive load a is greater than load b. Field of alternator G_B is excited so that the generated current I_B leads the terminal voltage V_B at p.f. cos ϕ_B. The excitation of G_A must be so adjusted that the machine operates at p.f. cos ϕ_A lagging. The in-phase current will flow from B to A as alternator G_B must supply the additional power for the supply area a, but the reactive current will flow from A to B due to the lagging and leading generated current I_A and I_B.

The current vector I_{c4} lies in quadrant (4) (180 to 270 deg). The power is represented by $\overline{07}$, reactive power by $\overline{08}$ leading the voltage V_B.

Thus the reactive current flowing from A to B is lagging referred to V_A when the power is transmitted from station A to B and leads the voltage V_B when power is delivered from B to A.

Numerical Example

Load a kW_a = 10,000 kW at p.f. 0·7 lagging; load b kW_b = 20,000 kW at p.f. 0·7 lagging. Generated power kW_A = 15,000 kW; kW_B = 15,000 kW; line voltage $V_A = V_B$ = 6,600 V; phase voltage $6{,}600/\sqrt{3}$ = 3,810.

Case 1.—Field excitation of G_A so adjusted that machine generates current I_A at p.f. 0·7 lagging. Find I_{c1} and cos ϕ_B.

Generated current I_A: $I_A = \dfrac{kW_A \,.\, 1{,}000}{\sqrt{3}\, V_A \cos \phi_A} = \dfrac{15{,}000 \,.\, 1{,}000}{1{\cdot}73 \,.\, 6{,}600 \,.\, 0{\cdot}7} = 1{,}875^A$

or $I_A = 1{,}875 (\cos \phi_A - j \sin \phi_A) = 1{,}875 (0{\cdot}7 - j\, 0{\cdot}7) = 1{,}312 - j\, 1{,}312.$

Load current I_a: $I_a = \dfrac{kW_a \,.\, 1{,}000}{\sqrt{3}\, V_a \cos \phi_a} = \dfrac{10{,}000 \,.\, 1{,}000}{1{\cdot}73 \,.\, 6{,}600 \,.\, 0{\cdot}7} = 1{,}250^A$

or $I_a = 1{,}250 (\cos \phi_a - j \sin \phi_a) = 1{,}250 (0{\cdot}7 - j\, 0{\cdot}7) = 875 - j\, 875.$

Interconnector Current I_{c1}: $I_{c1} = I_A \triangle I_a = 1{,}312 - j\, 1{,}312 - (875 - j\, 875) = 437 - j\, 437.$

Phase angle ϕ_{c1}: $\tan \phi_{c1} = \dfrac{-437}{437} = -1$

$\phi_{c1} = -45°$: cos $\phi_{c1} = 0{\cdot}7$ lagging, hence $I_{c1} = 437/\cos \phi_{c1} = 437/0{\cdot}7 = 625^A \,\underline{|\, -45°}.$

Generated current I_B: $I_B = I_b \triangle I_{c1}$.

Load current I_b: $I_b = \dfrac{kW_b \,.\, 1{,}000}{\sqrt{3}\, V_B \cos \phi_b} = \dfrac{20{,}000 \,.\, 1{,}000}{1{\cdot}73 \,.\, 6{,}600 \,.\, 0{\cdot}7} = 2{,}500^A$

or $I_b = 2{,}500 (\cos \phi_b - j \sin \phi_b) = 2{,}500 (0{\cdot}7 - j\, 0{\cdot}7) = 1{,}750 - j\, 1{,}750$, hence $I_B = 1{,}750 - j\, 1{,}750 - (437 - j\, 437) = 1{,}313 - j\, 1{,}313.$

Phase angle ϕ_B: $\tan \phi_B = \dfrac{-1{,}313}{1{,}313} = -1$

$\phi_B = -45°$: cos $\phi_B = 0{\cdot}7$ lagging

$I_B = \dfrac{1{,}313}{\cos \phi_B} = 1{,}313/0{\cdot}7 = 1{,}875 \,\underline{|\, -45°}.$

Alternator G_B operates at p.f. 0·7 lagging. Total current $I_{c1} = 625^A \,\underline{|\, -45}$ deg lags behind V_A, its vector lies in quadrant (1). The in-phase current $I_{c1} \cos \phi_{c1} = 437^A$ and the reactive current $I_{c1} \sin \phi_{c1} = -j\, 437^A$ flow from A to B.

Check: Power P_{c1} transmitted from A to B must be 5,000 kW and the generated power P_{GB} = 15,000 kW.

$P_{c1} = \sqrt{3}\, V_A\, I_{c1} \cos \phi_{c1} =$
$1{\cdot}73 \,.\, 6{,}600 \,.\, 625 \,.\, 0{\cdot}7 \simeq 5{,}000$ kW.

$P_{GB} = \sqrt{3}\, V_B\, I_B \cos \phi_B =$
$1{\cdot}73 \,.\, 6{,}600 \,.\, 1{,}875 \,.\, 0{\cdot}7 \simeq 15{,}000$ kW.

Case 2.—Field excitation of G_A so adjusted that machine generates current I_A in phase with the voltage. Find I_{c2} and cos ϕ_B.

Generated current I_A: $I_A = \dfrac{kW_A \,.\, 1{,}000}{\sqrt{3} \,.\, V_A} = \dfrac{15{,}000 \,.\, 1{,}000}{1{\cdot}73 \,.\, 6{,}600} = 1{,}312^A$

or $I_A = 1{,}312 - j\, 0$

Load current I_a: $I_a = 875 - j\, 875.$

Current in interconnector I_{c2}: $I_{c2} = I_A \triangle I_a = 1{,}312 - (875 - j\, 875) = 437 + j\, 875.$

Phase angle ϕ_{c2}: $\tan \phi_{c2} = 875/437 = 1{\cdot}98$

$\phi_{c2} = 63{\cdot}2°$: cos $\phi_{c2} = 0{\cdot}45$ leading, hence

$I_{c2} = 437/\cos \phi_{c2} = 437/0{\cdot}45 = 980^{A} \mid 63{\cdot}2°$.

Generated current I_B: $I_B = I_b \triangleq I_{c2} = 1{,}750 - j\,1{,}750 - (437 + j\,875) = 1{,}313 - j\,2{,}625$.

Phase angle ϕ_B: $\tan \phi_B = -\frac{2{,}625}{1{,}313} \simeq -2$

$\phi_B = -64°$: $\cos \phi_B = 0{\cdot}44$ lagging, hence $I_B = 1{,}313/\cos \phi_B = 1{,}313/0{\cdot}44 = 2{,}980^{A} \mid -64°$.

Alternator G_B operates at p.f. 0·44 lagging. Total current $I_{c2} = 980 \mid 63{\cdot}2°$ leads the voltage V_A; its vector lies in quadrant (**2**). The in-phase current $I_{c2} \cos \phi_{c2} = 437^{A}$ flows from A to B and the reactive current $I_{c2} \sin \phi_{c2} = +j\,875$ from B to A, as $I_{c2} \sin \phi_{c2}$ is opposite to $I_{c1} \sin \phi_{c1}$.

Check: Power P_{c2} transmitted from A to B must be 5,000 kW and generated power $P_{GB} = 15{,}000$ kW.

$$P_{c2} = \sqrt{3}\, V_A\, I_{c2} \cos \phi_{c2} =$$
$$1{\cdot}73 \,.\, 6{,}600 \,.\, 980 \,.\, 0{\cdot}45 \simeq 5{,}000 \text{ kW}.$$
$$P_{GB} = \sqrt{3}\, V_B\, I_B \cos \phi_B =$$
$$1{\cdot}73 \,.\, 6{,}600 \,.\, 2{,}980 \,.\, 0{\cdot}44 = 15{,}000 \text{ kW}.$$

Case 3.—Load a $kW_a = 20{,}000$ kW at p.f. 0·7 lagging; load b $kW_b = 10{,}000$ kW at p.f. 0·7 lagging. Field excitation of G_A so adjusted that machine generates current I_A in phase with the voltage V_A. Find I_{c3} and $\cos \phi_B$.

Generated current I_A: $I_A = 1{,}312 - j\,0$

Load current I_a: $I_a = \frac{20{,}000 \,.\, 1{,}000}{1{\cdot}73 \,.\, 6{,}600 \,.\, 0{\cdot}7} = 2{,}500^{A}$ or $I_a = 2{,}500\,(0{\cdot}7 - j\,0{\cdot}7) = 1{,}750 - j\,1{,}750$.

Current in interconnector I_{c3}: $I_{c3} = I_a \triangleq I_A = 1{,}750 - j\,1{,}750 - 1{,}312 = 438 - j\,1{,}750$.

Phase angle ϕ_{c3}: $\tan \phi_{c3} = (-1{,}750)/438 \simeq -4$: $\phi_{c3} = -76$: $\cos \phi_{c3} = 0{\cdot}245$ lagging, hence $I_{c3} = 438/\cos \phi_{c3} = 438/0{\cdot}245 = 1{,}800 \mid -76°$.

Generated current I_B: $I_B = I_b \mathbin{\hat{+}} I_{c3}$.

Load current $I_b = \frac{10{,}000 \,.\, 1{,}000}{\sqrt{3}\ 6{,}600 \,.\, 0{\cdot}7} = 1{,}250^{A}$, or $I_b = 1{,}250\,(0{\cdot}7 - j\,0{\cdot}7) = 875 - j\,875$. $I_B = 875 - j\,875 + 438 - j\,1{,}750 = 1{,}313 - j\,2{,}625$.

Phase angle ϕ_B: $\tan \phi_B = (-2{,}625)/1{,}313 \simeq -2$ $\phi_B = -64°$ $\cos \phi_B = 0{\cdot}44$ lagging, hence $I_B = 1{,}313/0{\cdot}44 = 2{,}980 \mid -64°$.

Alternator G_B operates at p.f. 0·44 lagging. Total current $I_{c3} = 1{,}800 \mid -76°$ lags behind the voltage V_B; its vector lies in quadrant (**3**). The in-phase current $I_{c3} \cos \phi_{c3} = 438^{A}$ and the reactive current $I_{c3} \sin \phi_{c3} = -j1{,}750^{A}$ flows from B to A. As the voltage V_B is the reference vector the $(+j)$ axis becomes $(-j)$ and the real axis $(-)$ becomes $(+)$.

Check: Power P_{c3} transmitted from B to A must be 5,000 kW and the generated power $P_{GB} = 15{,}000$ kW.

$$P_{c3} = \sqrt{3}\, V_B\, I_{c3} \cos \phi_{c3} =$$
$$1{\cdot}73 \,.\, 6{,}600 \,.\, 1{,}800 \,.\, 0{\cdot}245 \simeq 5{,}000 \text{ kW}.$$
$$P_{GB} = \sqrt{3}\, V_B\, I_B \cos \phi_B =$$
$$1{\cdot}73 \,.\, 6{,}600 \,.\, 2{,}980 \,.\, 0{\cdot}44 \simeq 15{,}000 \text{ kW}.$$

Case 4.—Load a $kW_a = 20{,}000$ kW at p.f. 0·7 lagging. Load b $kW_b = 10{,}000$ kW at p.f. 0·7 lagging. Field excitation of G_B so adjusted that alternator generates current I_B at p.f. 0·7 leading. Find I_{c4} and $\cos \phi_A$.

Generated current I_B: $I_B = 1{,}313 + j\,1{,}313$.

Load current I_b: $I_b = 875 - j\,875$.

Current in interconnector I_{c4}: $I_{c4} = I_B \triangleq I_b = 1{,}313 + j\ 1{,}313 - (875 - j\ 875) = 438 + j\,2{,}188$.

Phase angle ϕ_{c4}: $\tan \phi_{c4} = 2{,}188/438 = 4{\cdot}95$: $\phi_{c4} = 78{\cdot}6°$ $\cos \phi_{c4} = 0{\cdot}2$ leading, hence $I_{c4} = 438/\cos \phi_{c4} = 438/0{\cdot}2 = 2{,}200^{A} \mid 78{\cdot}6°$.

Generated current I_A: $I_A = I_a \triangleq I_{c4}$; $I_a = 1{,}750 - j\,1{,}750$; $I_A = 1{,}750 - j\,1{,}750 - (438 + j\,2{,}188) = 1{,}312 - j\,3{,}938$.

Phase angle ϕ_A: $\tan \phi_A = (-3{,}938)/1{,}312 = -3$; $\phi_A = -72°$; $\cos \phi_A = 0{\cdot}3$ lagging, hence $I_A = 1312/\cos \phi_A = 1{,}312/0{\cdot}3 = 4{,}375^{A} \mid -72°$.

Alternator G_A operates at p.f. 0·3 lagging. Total current $I_{c4} = 2{,}200 \mid 78{\cdot}6°$ leads the voltage V_B; its vector lies in quadrant (**4**). The in-phase current $I_{c4} \cos \phi_{c4} = 438^{A}$ flows from B to A and the reactive current $I_{c4} \sin \phi_{c4} = +j\,2{,}188^{A}$ from A to B as $I_{c4} \sin \phi_{c4}$ is opposite to $I_{c3} \sin \phi_{c3}$. As the voltage V_B is the reference vector the $(-j)$ axis becomes $(+j)$ and the real axis $(-)$ becomes $(+)$.

Check: Power P_{c4} transmitted from B to A must be 5,000 kW and the generated power $P_{GA} = 15{,}000$ kW.

$$P_{c4} = \sqrt{3}\, V_B\, I_{c4} \cos \phi_{c4} =$$
$$1{\cdot}73 \,.\, 6{,}600 \,.\, 2{,}200 \,.\, 0{\cdot}2 \simeq 5{,}000 \text{ kW}.$$
$$P_{GA} = \sqrt{3}\, V_A\, I_A \cos \phi_A =$$
$$1{\cdot}73 \,.\, 6{,}600 \,.\, 4{,}375 \,.\, 0{\cdot}3 = 15{,}000 \text{ kW}.$$

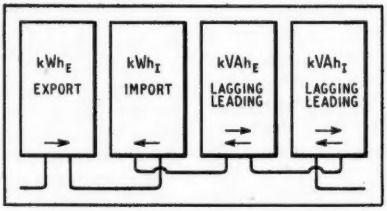
Metering

(*a*) Power. Two kWh meters, one for export kWh_E (see Fig. 3) and the second for import kWh_I, are inserted in the interconnector circuit (see Fig. 1, point **M**). The current coils of the kWh_I meter are reversed connected and both meters are fitted with ratchet and pawls to prevent backwards rotation.

(*b*) Reactive Power. The number of meters inserted depends on the tariff. In case the wattless kVAh are not charged separately in both directions, two meters will be necessary

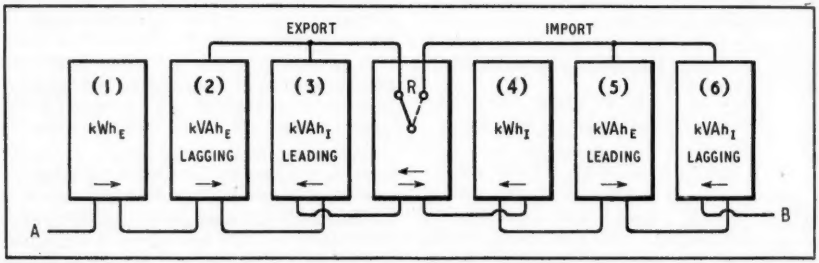
for registering of the wattless consumption. One meter will register the lagging and leading export kVAh ($kVAh_E$), the second will record the lagging and leading import kVAh ($kVAh_I$). The current coils of meter $kVAh_I$ are reversed connected. Both meters are fitted with ratchet and pawls to prevent backward rotation.

In case the wattless kVAh are separately



For recording the total consumption, consuming area (a) plus power transmitted by interconnector C, at M_G in Fig. 1, three meters are inserted, one for the kWh, the second for the reactive kVAh lagging, and the third for the reactive kVAh leading.

It is noteworthy that in high-voltage lines the reactive meters are usually identical with the watt-hour meters.



Figs. 3 (above) and 4.—Connection of kWh and reactive kVAh meters for export and import. In Fig. 3 reactive kVAh are not separately charged in both directions

charged for in both directions (Continental practice), four meters will be necessary. All together six meters are inserted in the interconnector circuit (Fig. 4). Two meters for registering of export and import kWh and four meters for the reactive kVAh. The meters are fitted with ratchet and pawls. In addition, a relay R is inserted in the circuit. The relay is a converted watt-hour meter which rotates in both directions and brings one set of reactive meters, either (2) and (3) or (5) and (6) to a standstill by energizing a relay which has a braking effect on the armature of the meter.

For example: The current I_c flows from A to B and lags behind the voltage (quadrant (1)). Meter (1) registers kWh_E, meter (2) reactive lagging kVAh, meters (3) and (4) are blocked, relay R rotates in the same direction as meter (1) and brings meters (5) and (6) to a standstill.

Second example: Current I_{c4} lies in the quadrant (4). The in-phase current flows from B to A, the reactive current from A to B. Meter (4) registers kWh_I, relay R rotates in the same direction as (4) and brings meters (2) and (3) to a standstill. Meter (6) registers the reactive leading kVAh, (1) and (5) are blocked.

With aid of an external reactive coil or a quadrature transformer, the voltage circuit of the reactive meters can be modified, in this way causing the meter to register reactive kVAh.

Metal-Finishing Processes

THE Research Board of the British Non-ferrous Metals Research Association has decided to undertake in its own laboratories in London investigations into metal-finishing processes in parallel with the work on other aspects of metal quality which has been its concern for so many years.

The laboratories' new metal finishing section will include an experimental electro-plating shop and a special laboratory for research of a more fundamental kind. The work of this section will be under the immediate supervision of Mr. E. A. Ollard, who is well known in the electro-plating industry.

The new facilities, coupled with the information and technical advisory services which the Association provides for its members, will be at the disposal of British plating firms so co-operation from a much wider section of the metal finishing industry must be secured. Therefore, the Association wishes to make contact with all firms interested in the project, other than paint or lacquer firms.

Royal Train

Equipment of Coaches for South African Tour

LAST week we visited the Saltley, Birmingham, works of the Metropolitan-Cammell Carriage & Wagon Co., Ltd., to inspect some of the coaches which the company has constructed for the South African Railways, which will form part of the Royal train to be used during Their Majesties' tour of the Union next year. The train will consist of fourteen coaches; eight of these are now being supplied by the Metropolitan-Cammell Co., and the remainder will comprise a lounge car, kitchen cars, diners and baggage car drawn from the existing South African "Blue Train" stock, which was supplied by the company for the Cape Town-Johannesburg service in 1938-39. Four coaches are also being made by the Metropolitan-Cammell Co., two of which are set apart for the use of Field-Marshal Smuts.

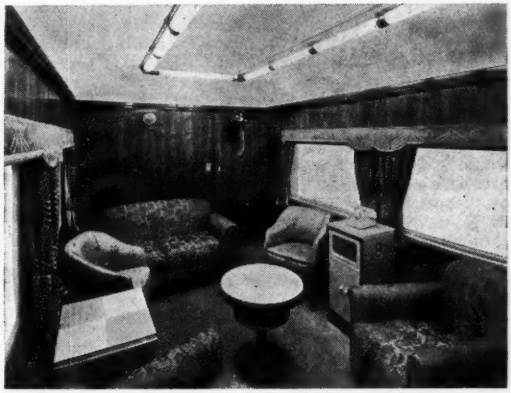
The cars are being built to the general requirements of Dr. M. M. Loubser, chief mechanical engineer of the South African Railways and Harbours Administration, under the general supervision of Mr. H. D. Ward Smith, advisory engineer in London. They are designed to provide the maximum of comfort and the furnishings are dignified and unostentatious. The four cars which have been completed and which we inspected last week, are the King's car, the Queen's car, the Princesses' car and the staff car.

A considerable amount of electrical equipment has been installed in each of the coaches, the main sub-contractors for which were J. Stone & Co., Ltd. The electric power supply for all auxiliaries is supplied from axle-driven 110-V d.c. generators installed by J. Stone & Co. Chloride batteries are carried on the underframe of the coaches which maintain full services for all normal operational standing periods, but for exceptional standing periods provision is made for maintaining all services by feeding in a.c. or d.c. supply.

Stone-Carrier air-conditioning equipment provides an appropriate quantity of air for the cars and the windows are sealed and fitted with double glazing which excludes draughts, dust and noise. Air is admitted to the coaches through grilles in the coach side and is filtered, cooled or warmed, as necessary, and distributed through ducts in the coach ceiling, passing into the coach through multi-vent diffuser panels. Temperature control is thermostatic.

All the coaches have fluorescent lighting, and nearly 300 lighting fittings, designed and supplied by the General Electric Co., Ltd., to the requirements of J. Stone & Co., have been supplied. These fittings incorporate 2-ft 20-W fluorescent tubes. The ceiling fittings are of chromium with frosted ribbed glass concealing the tubes. This lighting scheme covers all the main apartments in the train as well as the corridors and vestibules, with similar lighting over shaving and dressing-table mirrors.

New frequency-modulated radio-telephone equipment developed by the G.E.C. will be installed in the Royal train and a pilot train, which will travel about ten miles ahead of it, to enable the two trains to maintain constant communication. The 100-W transmitter and receiver will be housed in a compartment in the Royal train. The G.E.C. has also supplied twelve portable electric fires for the Royal coaches which are specially designed with heavy bases to maintain stability while the train is in motion.



Fluorescent lighting in the lounge car

A "Strowger" automatic telephone exchange, supplied by the Automatic Telephone & Electric Co., Ltd., will enable the Royal Family and entourage to communicate with each other from any part of the train. All telephones are fitted with a special device to prevent the hand sets from rattling. At each of the points of call *en route* the exchange will be connected to the South African telephone network.

The Marconi Co. has been entrusted with the work of equipping the train with broadcasting receiving equipment and facilities for making announcements over more than sixty loud

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speakers on the train; a specially designed receiver cabinet has been installed for the King's personal use. In addition the pilot train is to have a Marconi high-speed short-wave transmitter and keying equipment, together with a short-wave receiver for the transmission of Press reports of the tour and for general communication purposes. Power for the main transmitter will be supplied from a 3-kVA Diesel alternator set, fitted with special silencing and cooling systems, and be mounted on shock absorbing mountings.

Philips Industrial (Philips Lamps, Ltd.) are supplying sixteen motor-generator sets to the South African Railways and Harbours, and two of these will be used on the Royal train and will supply all the current necessary to operate the radio transmitters and receivers installed.

Decca " Decola " electric record reproducers are included in the furnishings of the Royal train and electrical suppression apparatus has been installed by Belling & Lee, Ltd.

Generation and Distribution

Should They Be Segregated?

THE effect on the electricity supply industry and consumers of separating generation and main transmission from distribution, especially where undertakings operate over wide and dispersed areas, forms the subject of a report by a committee (chairman, Lt. Col. E. H. E. Woodward) appointed by the Incorporated Association of Electric Power Companies. After pointing out that the production and distribution of electricity are inherently concurrent, the Committee refers to the need for the price of electricity supplied to industry (which takes 65 per cent of the total kWh sold) to be in proper relationship with costs of competitive sources of power, which vary according to location, e.g., the proximity of coal fields. It is argued that if the object be to standardize charges, these would have to be raised in present low-cost areas to subsidize others and that this would result in loss of industrial business and inability to make such assistance substantial. Many special loads could be supplied only through the flexibility provided by the co-ordination of generation and distribution by the same undertaking. Similar considerations applied to linking up of public supply with industries possessing waste heat resources and requiring supplementary and stand-by supplies.

It is pointed out that main transmission lines often later become distributors and that their transfer to a separate generating authority would entail capital expenditure in providing additional distributors. Higher operating and maintenance costs are envisaged for two organizations, owing to duplication of equipment required for generation and transmission and distribution. Departure from the present complete co-ordination of generating and distributing operations, which facilitated prompt action, would entail complicated precautions for securing safety of the staff, involving operational delays and inconvenience to consumers, and would destroy facilities for interchange of duties under one management and limit employees' prospects. These objections were avoided under the 1926 Act by providing that the Central Electricity Board should neither own nor operate stations if the undertakings concerned were able to do so.

Fulham Extensions

New Generator Started Up

THE fifth 60-MW Metrovick turbo-alternator, the last unit to be provided at the Fulham power station under the latest extension scheme, was officially started up on Wednesday last week by the Mayor, Councillor C. P. de Winter. With the 10-MW house set, this brings the generating capacity of the station up to 310 MW. Like the other four sets, the new unit runs at 1,500 r.p.m. and generates at 11 kV, stepped up to 66 kV by a direct-coupled 66,667-kVA transformer. It is hoped to place it on load by the end of the month. An interesting feature is that all the turbine gauge panels have been centralized on a single board. As part of the extension scheme three new 315,000 lb per hr Stirling boilers, operating at 850 deg F and 625 lb per sq in., are being added to the thirteen already in service. They are being provided with Taylor automatic stokers and Kent control panels.

Introducing to the Mayor all those who were responsible for the installation of the plant, Mr. W. C. Parker, the borough electrical engineer, claimed that Fulham would be the first station planned to be finished in 1946 that would actually be finished in 1946. The Mayor wished the station every success, and Councillor J. W. Perotti, chairman of the Electricity Committee, said they could be justifiably proud of the plant.

NEW COLLIERS.—To replace the craft sunk during the war three new Diesel colliers are being constructed. The first of these should be in service by next April, the other two later in 1947.

Industrial Law Course

IMPORTANT changes in industrial law have taken place recently. This fact gives special interest to the Industrial Welfare Society's postal course in industrial law which has now been conducted for some years. The course consists of six lectures which are constantly reviewed so as to be up-to-date, and it covers the whole field of employment and factory law, with which management and executives in industry are concerned. Particulars of the course can be obtained on application to the secretary of the Society, 14, Hobart Place, Westminster, London, S.W.1.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE University of London has conferred the title of Professor Emeritus upon **Professor C. L. Fortescue** (electrical engineering), **Professor C. H. Lander** (engineering) and **Professor E. F. Dolby Witchell** (mechanical engineering), who retired from the Imperial College last September. **Professor R. O. Kapp** has been elected Dean of the Engineering Faculty for the period 1946-48.

Dr. F. C. Williams, O.B.E., D.Sc. (Manchester), D.Phil. (Oxford), A.M.I.E.E., has been appointed Edward Stocks Massey Professor of Electro-Technics and Director of the Electro-Technical Laboratories in the University of Manchester, in succession to Prof. Willis Jackson, and will take up his new duties at the beginning of the Lent Term. Dr. Williams graduated at Manchester University with first class honours in engineering in 1932, being awarded the Fairbairn Prize and the Matthew Kirtley Senior Scholarship.

Dr. F. C. Williams

He took the degree of M.Sc. in 1933 and that of D.Sc. in 1939. After serving an apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park, he was awarded the Ferranti Scholarship of the I.E.E. and went to Oxford University (Magdalen College), where he carried out research in the engineering laboratories under the supervision of Prof. E. B. Moullin on the subject of fluctuation noise in amplifiers. In 1936 he graduated as a Doctor of Philosophy.

Returning to Manchester University he became assistant lecturer on radio and cognate subjects in the Electro-Technics Department, and during this period carried out research work on fluctuation noise, diode rectifiers; and circuit problems of the electronic variety. From 1939 to 1946 he was a member of the Scientific Civil Service, of which he became principal scientific officer, his work including circuit design and the development of radar. He was awarded an I.E.E. Premium this year for a paper on "Introduction to Circuit Techniques for Radio Location," and he is a member of the Council of the I.E.E. He has visited the United States in connection with radar research.

Dr. J. F. Crowley, M.I.E.E., consulting engineer, is leaving on November 25th for a fortnight's lecture tour in Italy for the British Council. He will visit Rome, Milan and Turin, and will lecture on "Production, Distribution and Utilization of Electricity in Great Britain," "Electricity as a Factor in the Improvement of Social Amenities," and "Modern Developments in Engineering Construction." Before the war he was consultant to an Italian concern and is, therefore, in a good position to know what British achievements in electrical engineering are likely to be of particular interest to the Italians.

Oban Town Council has appointed **Mr. R. Fyfe**, A.M.I.E.E., Perth, an official of the Grampian Electricity Co., to be burgh electrical engineer in succession to **Mr. C. Saddington**, who has retired.

Mr. Ivor G. Evans, A.M.I.E.E., A.M.I.Mech.E., engineer to the Portland U.D.C. Electricity Department, has been appointed electrical engineer to the Pontypridd U.D.C. Before going to Portland, Mr. Evans was works superintendent and deputy engineer in the Rhondda U.D.C. Electricity Department. He attended the South Wales and Monmouthshire School of Mines, obtaining a silver medal and national certificates, and received his training with Insoles, Ltd., Porth.

Mr. L. E. A. Phillips has been appointed manager of the drawing office at the head office of the General Electric Co., Ltd., which is responsible for the design of all the company's decorative fittings. Mr. Phillips, who has been with the G.E.C. for twenty-four years, succeeds **Mr. E. H. Penwarden**, who recently retired after being with the company since 1915. Although he was primarily concerned with lighting schemes, Mr. Penwarden latterly collaborated in the design of domestic appliances. He was a member of the G.E.C. Dramatic Society from its formation in 1930.

At the seventh annual general meeting of the British Valve Manufacturers' Association held on November 20th at Grosvenor House, London, **Mr. J. M. Storey**, managing director of Dewrance & Co., Ltd., was elected chairman for the ensuing year, in succession to **Mr. R. A. Blakeborough**, chairman and managing director of J. Blakeborough & Sons, Ltd.

Mr. H. E. Hartland who, until his recent illness had been actively engaged as representative for W. H. Keys, Ltd., for over fifty years, has retired. With the exception of a short period at Newcastle-on-Tyne his activities were centred in the Midlands. The directors and staff are making a suitable acknowledgment of his services.

"Brush Sports" Football Club of the Brush Electrical Engineering Co., Ltd., Loughborough, entered this season for the F.A. Cup and has succeeded in winning the qualifying round. By beating Shrewsbury Town on November 16th by five goals to one the team has reached the first round proper and has been drawn against

Southend United, a leading League III (South) team. The members are employed by day and trained by night. The team plays in the Notts and Derby League and is unbeaten this season. It is the only one from industry to succeed in reaching the first round proper of the F.A. Cup. "The Gothics" (the football club of the Norwich works of Laurence, Scott & Electromotors) meeting Colchester United in the last qualifying round, lost by five goals to one.

Alderman C. W. Dixon, who is the new Mayor of East Ham, has been chairman and vice-chairman of the East Ham Electricity Committee for fourteen years, and for thirteen years has been on the Electricity Supply Industry District Joint Board (No. 10 Area). He has also served on the District Joint Committee of Local Authorities' Undertakings and Chief Electrical Engineers, and has recently been elected to the Council of the I.M.E.A. The mayor-making ceremony took place recently in the large hall of the Town Hall, and during the evening Mr. G. W. Ablitt, the electrical engineer and manager, presented the Mayor, on behalf of the staff and himself, with an album to mark his long association with the undertaking.

Mr. W. H. Sugden, manager and director of W. H. Sugden & Co., Ltd., electrical engineers, Barking, has been re-elected after twelve years' service as a councillor for the borough.

Mr. H. B. M'Kinty, M.C., B.L., secretary of the Scottish Power Co., Ltd., has been appointed to the board of the company.

Mr. C. M. Nesbitt, sales manager of Dorman & Smith, Ltd., and the associated company, D.S. Plugs, Ltd., is leaving this country very shortly for an extended business tour of India and Ceylon. He expects to be away for six months.

The new name of the Old Cromptonians' Association, of which the **Earl of Mount Edgcumbe** is president, is "The Cromptonian Association" and not as given in our issue of November 15th.

Mr. G. E. Velge, A.M.I.E.E., has resigned after seventeen years' service with the Lancashire Dynamo & Crypto, Ltd., and has accepted a post as production engineer with an engineering company at Slough, Bucks.

Members of the Caroline Haslett Trust Committee assembled at the E.A.W. Headquarters at 35, Grosvenor Place, S.W.1, on November 18th to say farewell to **Miss Joan Whitgift,** whom many of our readers will recognize as the daughter of Mr. M. Whitgift, hon. secretary of the Batti-Wallahs' Society. As the first holder of the Caroline Haslett Travelling Exhibition, she left for the United States on November 20th. The purpose of the Travelling Exhibition is to enable a holder of the E.A.W. Diploma to study home economics in another country, and particularly the application of electricity to housecraft. Miss Whitgift will have the assistance of a committee of leading American home economics women in planning her itinerary, which will include visits to works where domestic electrical equipment is manufactured and to departments where its operation is studied.

Mr. R. F. Hearn, senior meter tester and repairer with the West Midland Joint Electricity Authority, has been appointed meter and test superintendent with the Milford Haven U.D.C. Electricity Department.

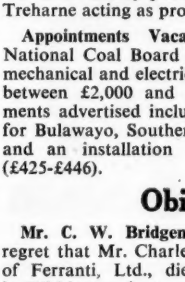
Mr. A. G. Everett, works manager of the Brimsdown factory of the Cosmos Manufacturing Co., Ltd., has been appointed to the board of the company.

Three performances of Noel Coward's light comedy, "I'll Leave it to You," were given recently at Cardiff by the "Star Delta Players." This was the eighth production of the dramatic society, all the members of which are on the staff of the South Wales Electric Power Co. Mr. S. R. Butley produced the play, Mr. C. G. Treharne acting as production manager.

Appointments Vacant.—In this issue the National Coal Board is advertising for a chief mechanical and electrical engineer at a salary of between £2,000 and £3,000. Other appointments advertised include a generation engineer for Bulawayo, Southern Rhodesia (£770-£935); and an installation engineer for Dewsbury (£425-£446).

Obituary

Mr. C. W. Bridgen.—We learn with great regret that Mr. Charles W. Bridgen, a direcfor of Ferranti, Ltd., died suddenly at his home in Withington last week, aged fifty-one. Mr. Bridgen joined the Ferranti staff in 1913. He was with the London Regiment in France from 1915 to 1919 and, returning to Hollinwood, he was engaged for a time on experimental work before being transferred to the commercial side of the company's activities. He became district manager of the Midlands and South Western Areas in 1930, and was promoted to the position of general sales manager in 1934. He joined the board in 1943. Mr. Bridgen was a member of the Council of the I.E.E., member of the I.M.E.A.-B.E.A.M.A. Joint Committee and vice-chairman of the Meter Manufacturers' Association. He leaves a widow and four daughters. The funeral at the Manchester Crematorium on November 22nd was attended by a large number of friends, including the chairman, directors and members of the staff of Ferranti, Ltd.



The late Mr. C. W. Bridgen

Mr. F. E. Shipley, who had represented Chamberlain & Hookham, Ltd., in the West of England and South Wales for the past eighteen years, died suddenly on November 17th. Mr. Shipley, who was fifty-four, joined the staff of Chamberlain & Hookham in 1912.

Mr. G. H. Wilson.—The death occurred suddenly on November 17th of Mr. George H. Wilson, who was for many years connected with the G.E.C. Laboratories.

Wills.—Mr. M. H. Kilgour, first borough electrical engineer of Cheltenham, and formerly Division Officer, Royal Engineers, Chelmsford, left £15,408 gross (net personalty £15,294).

Mr. A. A. Van Rood, of the Marconi Co., Chelmsford, left £3,277 (net personalty £3,208).

New Switchgear at Long Eaton

THE bulk supply given at 11-kV to the Long Eaton undertaking by the Derby and Notts. Power Co. has been augmented by the bringing in of 33-kV lines to a new 33/11-kV outdoor transformer. As the existing 11-kV switchgear was inadequate to deal with the fault currents now possible, new circuit-breakers with an A.S.T.A.-certified rupturing capacity of 250-MVA have been installed at a cost of £8,250. The installation, by Switchgear & Cowans, Ltd., to the specification of the electrical engineer and manager, Mr. J. B. Feltham, comprises twelve air-insulated cubicles and solenoid-remote-controlled low-oil content circuit-breakers with isolators and interlocks. These are erected on one side of the main switch room measuring 50 by 26 by 14 ft (high). Along the opposite side are ranged the fifteen cubicles of the double bus-bar switchgear of the Derby & Notts. Power Co. The Mulsifyre protection system of Mather & Platt, Ltd., is to be extended to the main switch room.

The new switchgear was put into operation on November 14th by Councillor A. E. Wigginton (chairman, Long Eaton U.D.C.). At the lunch given by the Council and the contractors, Alderman H. Varley (chairman, Chesterfield Electricity Committee) stated that since Mr. Feltham's appointment in 1933 the annual output of the Long Eaton undertaking had risen from 4½ million to 12½ million kWh. About 94½ per cent of possible consumers were connected. Councillor J. R. Davis (chairman, Long Eaton Electricity Committee) said that, although on the side of the present Government, he disagreed with the policy of nationalization of electricity supply; he much preferred its municipalization.

Mr. Feltham furnished some technical particulars of the undertaking and announced that at the end of September the pre-war charges for electricity had been restored and that, for the six months ending March 31st next, there would be a special rebate to consumers of 15 per cent. Mr. J. L. Rowbothom (general manager of the contractors) and Mr. C. R. King, also spoke.

Detection of Fish

THE British Export Trade Research Organization, which was launched about eighteen months ago to undertake scientific research relating to overseas markets, held a conference on November 21st. MR. LESLIE GAMAGE (chairman, B.E.T.R.O.), describing the activities of the Organization, instanced the aid it had given to Marine Instruments, Ltd., through its ability to furnish accurate information regarding the catches of fish in various countries with a view to extending the scope of the recording echo-sounder to the location of fishing grounds. MR. FRANCIS HUGHES (Marine Instruments, Ltd.), referring to the hydrographic surveys carried out by his company, mentioned the distinctive features of its echo-sounder, viz. that the super-sonic oscillator (transmitting at 15,800 cycles per sec) could be installed anywhere inside the ship's hull (thus facilitating servicing) and the "wet" paper electrochemical recorder was of great sensitivity. In this instrument, which was subsequently demonstrated, a control switch closes and operates a relay in the contactor allowing current to pass from a charged condenser through the transmitter windings, thus causing the emission of a sound impulse. Its "echo" from the sea-bed or other object is amplified electrically and applied to the stylus, which travels at a speed proportional to the speed of sound in water (i.e., four times the 744 m.p.h. in air) leaving a mark on the moving paper at a point that is accurately related to the echo time, thus building up a map of the area surveyed.

Regional Distribution

A DESCRIPTIVE account of the operation and maintenance of a regional system of distributing electricity formed the subject of the address by MR. T. M. AYRES (North-Eastern Electric Supply Co.) as chairman, North-Eastern Centre of the I.E.E.

The system dealt with has almost 2,500 miles of high-voltage circuits and nearly the same length of low-voltage distributors; a transformer capacity of 1·5 million kVA in 2,500 substations serving 4,500 sq miles.

The functions and procedure of various groups of the organization from the control room outward were described to indicate how system control is exercised, so permitting load allocation to different power stations in accordance with generating efficiency.

Mr. Ayres next turned to ways and means of regulating voltage, indicating their importance and complication; they needed careful planning and siting as well as skilled use. Finally reference was made to the manner in which maintenance work is organized and carried out, transport, telecommunications and records being ancillary yet important necessities because continuity of power supply was often dependent upon their reliability.

Electrical Development

Interim Report from E.D.A.

ACTIVE pursuit of its main objects and new ventures is indicated in an interim report prepared by the British Electrical Development Association. Much has been done to strengthen "public relations" under which heading come contacts with Members of Parliament (in a campaign for the removal of purchase tax from domestic appliances), assistance in scrutinizing B.B.C. scripts to prevent error, and collaboration with the Council of Industrial Design in the preparatory work for the "Britain Can Make It" Exhibition. Much assistance has been afforded to the press and publishers.

In co-operation with the Electrical Association for Women, a campaign was conducted for the removal of purchase tax on kettles, irons and washing machines. Success was achieved so far as the first two items were concerned.

Advertising adapted to to-day's circumstances has been continued and there has been co-operation with several Government Departments. Special reference is made to assistance given to the Board of Trade Hosiery Industry Working Party. In connection with the National Housing Drive the Association is collaborating with the appliance manufacturers' associations in dealing with supply problems, which have been few.

Advice on Housing

An information bulletin was issued on the maintenance of appliances in temporary houses and the Ministry of Works was approached with regard to deficiencies in the water-heating and wiring systems in these houses. Advice has been given to housing authorities, architects and builders on the electrical installations in permanent houses. Satisfactory results have come from discussions with manufacturers upon the provision of the standard service unit.

By the time the Government is ready to proceed with the building of schools a valuable and comprehensive report from the panel of consultant architects on the electrical equipment of schools will be available. The standardization of tariffs and rural electrification are also mentioned. Mr. F. Newey is representing the Association on the Commissioners' Committee on Tariffs. Preparatory work has been done in the production of a film and plans for agricultural show exhibits in 1947.

National and local exhibitions have been supported in various ways and the Association organized the successful exhibition at the I.M.E.A. Conference. Improvements are being made in the electrical section of the London Building Centre and electrical displays are being arranged at the Scottish Building Centre, Glasgow.

The subject of a National Testing House and a mark scheme has been discussed with the Trade Marks Department and the B.S.I. Electrical Industry Committee and the matter is now being further considered by the Area Committees.

Equipment for Domestic Science Schools

Reference is made to the Caroline Haslett Trust (Electrical Industry Scholarships) and to the re-opening in January last of the London School of Domestic Electrical Science. For many years the gas industry has provided equipment free of charge to domestic science training colleges. The Association is now countering this by supplying electrical equipment to the fifteen principal establishments of this kind at a cost of between £20,000 and £30,000. This expenditure is expected to have a very beneficial effect in the future. Inquiries from schools and educational bodies have shown a marked increase and much assistance in the way of lecture notes, films, etc., has been given. The films and lecture notes have also been furnished to a variety of other organizations.

There are also references to the salesmanship training course, collaboration with the National Federation of Registered House Builders, the sales management conference in May last, and the assisting of foreign visitors to this country. Brief note is made of the activities of the Electrical Vehicle Association.

The Association's latest posters, a series of five, are now appearing all over the country. They urge consumers to use electricity only during non-peak periods (times being given according to the locality) and reproductions are available for local newspaper advertisements.

Co-operation in Engineering

ACCOMPLISHMENTS of the Institution of Civil Engineers formed the subject of SIR WILLIAM HALCROW'S presidential address in London recently. He spoke first of the need for co-operation and co-ordination, pointing out obstacles to the presentation of the views of the engineering profession as a whole on matters of general and public interest. The advantages of amalgamation of some of the smaller institutions were so great that it was difficult to understand what those who opposed it expected to gain by standing aside. Effective union, or co-ordination of effort, should be encouraged. References were made to the Engineering Joint Council, the much closer co-operation of the "big three" Institutions and their successful conference this autumn with representatives of leading Commonwealth engineering societies, as well as various aspects of engineering education and training.

Electric Motor Enclosure

Terms Applied for Different Duties

By K. W. Jerome, Graduate I.E.E.

ALTHOUGH the more common types of motor enclosure available are clearly defined in B.S. 168—1936, "Industrial Electric Motors and Generators," there is still a tendency to looseness of nomenclature on the part of those responsible for specifying the kind required for any purpose, especially with regard to machines for export. Before placing an order for an electric motor, the site conditions should be carefully studied, as suitable protection must be afforded against the prevailing atmospheric conditions.

Method of Ventilation

The method of ventilation has to be considered as in a mill handling materials giving off fluffy particles, or where there are chemical fumes, it may be necessary to employ pipe or duct ventilation. The problem then arises whether the machine shall be allowed to discharge into the surrounding atmosphere, in the case of the mill motor, or to the outside of the building in the case of the motor operating in chemical fumes. These examples serve to show the necessity of stating definitely and clearly the type of enclosure required. Moreover, totally enclosed machines are frequently specified when totally enclosed, fan-cooled motors are actually required.

The type of enclosure determines the heat dissipating ability of the machine and consequently its rating, and B.S. 168 shows how it affects the permissible temperature rise. Thus a motor with windings insulated with "Class A" material has an allowable temperature rise of 40 deg C but when totally enclosed the limit is 50 deg C. As the size of the motor increases, the heat-dissipating surface of the enclosure per horse-power output decreases rapidly, so that enclosure is less economical on large, than on small machines.

Definitions for Special Types

In addition to the types of enclosure set out in B.S. 168, which should be carefully studied before ordering a motor, the following definitions are suggested to meet exceptional cases.

Canopy protected.—A canopy is fitted over the motor to protect the exposed parts from falling water or dirt.

Cowl ventilated.—Cowls are fitted to the openings, which are generally on top of the motor, to prevent the ingress of splashing water.

Deluge-proof.—The enclosure shall be able to withstand a torrent of water and be waterproof up to the centre line of the shaft.

Drip-proof.—The motor is provided with ventilation openings, so protected as to exclude falling water or dirt.

Dust-tight.—Total enclosure should suffice, but where dirt and dust conditions are severe, gaskets between the cores and the frame are recommended.

Splash-proof.—So provided with covers and baffles that it permits ventilation, yet protects the motor from splashes and jets of water projected upon it from any angle.

Submersible.—Capable of operating under water without ingress of liquid.

Weatherproof and/or Waterproof.—So provided with covers and baffles as to permit ventilation and yet prevent ingress of moisture; exposed parts are protected from corrosion.

Flameproof Machines

It should also be borne in mind that under certain modern conditions flameproof machines, as covered by B.S. 270 "Electric Motors and Generators for Use in Mines," are required on industrial premises. There is thus the further definition of flameproof (including explosion-proof) enclosure as capable of withstanding, without injury, any explosion that may occur in practice inside it, under the conditions of operation within the rating of the apparatus enclosed by it (and recognized overloads, if any, associated therewith), and of preventing the transmission of flame such as will ignite any inflammable mixture which may be present in the surrounding atmosphere. The requirements of gas-tight enclosure can be added as meaning total enclosure with gaskets between the cores and the frame, so as to exclude the surrounding atmosphere.

Commercial Travellers' Benevolent Institution.—The annual court of governors of the Institution will be held at 4b, Frederick's Place, Old Jewry, E.C.2, on December 28th at noon.

Domestic Appliance Design

Lecture for Sales Staffs

THE first of a series of lecture meetings arranged by the British Electrical Development Association for South East and East England Area undertakings' sales staffs was held at the E.L.M.A. Lecture Theatre, Savoy Hill, W.C.2, last Monday. "General Domestic Electrical Appliances" was the subject of the lecture given by MR. E. G. BATT, chairman of the Electrical Domestic Appliances Committee of B.E.A.M.A.

Opening the meeting, MR. H. J. RANDALL, chairman of the E.D.A. Council, said that it was most unfortunate that, with the present wave of enthusiasm for electricity, they had to contend with three great problems—shortage of generating plant, coal and appliances. Sales engineers and demonstrators could soothe the ruffled tempers that consumers would develop through not being able to get immediately the electrical labour-saving apparatus which they wanted.

Manufacturers' Handicaps

Speaking of the difficulties that confronted electrical apparatus manufacturers to-day, Mr. Batt said that, while the output of sheet steel was higher than before the war, the demand had gone up to such an extent that the Ministry of Supply had had to scale down allocations; the electrical industry was getting only 50 per cent of its normal requirements. The position relating to castings was very much the same. The output of ceramics was about 60 per cent of pre-war and there was no importation. The Government was opening a number of factories but it would be some time before their effect would be felt. Much training would have to be done to overcome the labour shortage. No manufacturer was allowed to construct apparatus unless he had a licence and 50 per cent had to go for export.

Referring to the question of shoddy apparatus, Mr. Batt said that the test authority (advocated in his paper at the I.M.E.A. Convention at Blackpool) to which makers could submit their apparatus voluntarily for criticism was within reasonable reach of formation. With regard to interchangeability of spare parts, agreement had been reached on rod-type heating elements and only awaited N.P.L. approval. Other types of heating element would be dealt with.

In the design of fires there was a tendency to change over from sheet steel to aluminium and experiments were proceeding with reinforced plastics and metallic finishes on wood. Owing to the ceramic position there was also a tendency to use more rod-type elements instead of the fire-bar type. The multi-parabola radiator covering 120 deg in the horizontal plane was another development. To increase efficiency, elements were being developed for operation at higher temperatures. It was hoped to produce a fire that was absolutely incapable of giving a shock or causing a fire. Smaller radiators were now becoming difficult to sell.

The output of electric cookers made by B.E.A.M.A. members had increased from 11,206 in June to 19,474 in October. Thermostatic oven and simmering controls, two hotplates, a grill-boiler and a reasonable sized oven were now considered as minimum requirements. The new cookers took up no more space than the pre-war models.

Cabinet washing machines were favoured in the country and there was a tendency towards more automatic operation. Wringers were found to be better for close-weave materials while spin drying was better for open-weave. Polychromatic finish on steel was replacing the more-difficult-to-get porcelain for irons, for which thermostatic control was strongly favoured. The 20-gal dual-purpose water heater was advocated by manufacturers as being much more efficient than immersion heaters inserted in a lagged tank.

The anticipated swing-over to the inset type refrigerator was not after all taking place and most of the business would be in the free-standing type. The greatest development would be in the sealed unit which he hoped would be interchangeable between various makes. Though the electrical manufacturers had had to design their refrigerators for use in prefabricated houses to fit a previously fixed space they had succeeded in producing units which had a capacity of 3·2 cu ft as compared with only 1·5 cu ft in the gas models and an operating cost only one-fifth that of gas. Mr. Batt thought there was a promising market for a small fan, not only for air extraction in the kitchen but also for drying cabinets.

A new development was the use of "Mycalex," powdered mica and glass, for the production of a panel heater. The material was put in a stout mould and then fused at a high temperature, with a 500-W element embedded. The resulting slab was entirely safe and was suitable for mounting directly on the wall.

Future Meetings

These lecture meetings are to be held at about monthly intervals, the topics to be dealt with including electric water heating development (provisional date, December 17th), commercial electric cooking development, selling good lighting (in conjunction with E.L.M.A.), space heating, the electric home laundry, and light industrial power applications. A special meeting for demonstrators, to be held in conjunction with the Ministry of Fuel, will deal with the work of the M.O.F. experimental kitchen and nutrition and the food supply position.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Electric Razors in Bathrooms

I HAVE read with interest Mr. Bland's letter on the use of electric razors in bathrooms since I have given this matter some thought over the past few years; his advice "Don't" is obviously correct but if the installation is insisted on, I feel that an isolation transformer would add a large degree of safety in the case of a.c. installations.

A similar problem exists in the use of inspection lamps in garages, and I believe that a satisfactory solution has been found in the use of a transformer with low voltage lamps.

Your readers' opinions on whether the centre of the razor winding should be earthed or left floating would be of interest.

London, W.2. G. R. WOODVILLE.

Motor Protection

IN his interesting article in last week's issue "Rotor" states: "For proper overload protection one trip element should be connected in each pole of a system which is not earthed." This is ambiguous for it gives the impression that three overload releases should be used on a three-phase insulated neutral system, whereas only two are necessary. For the normal earthed-neutral system, however, an overload in each phase is advisable.

In advocating a low-voltage release in every starter "with the possible exception of those for fractional-horse-power motors" the author appears to have overlooked I.E.E. Regulation No. 703, which requires the use of such a release with every motor exceeding a ½-HP rating.

Moreover, good practice now requires the use of a low-voltage release in every case when the unexpected restarting of a motor might cause injury to an operator—irrespective of the horse-power of the motor involved.

Chislehurst, Kent. A. N. D. KERR.

D.C. Motor Starters

WRITING in your issue of November 15th, Mr. K. Giles, criticizes an article by "Time Lag" on November 1st. The type of d.c. starter-regulator referred to was in common use 30 to 40 years ago, mainly for control of machine tools and printing presses where a wide range of speed control was desired, and I handled scores of these regulators in various forms when in the test department of a well-known firm of control gear manufacturers.

These regulators were similar to an ordinary face-plate starter, except that the resistance was continuously rated, and the no-volt magnet carried a detent extension to its armature, which engaged in slots cut in a quadrant formed on the hub of the starter arm.

Thus the arm could be left on any desired contact, but was still subject to no-volt and overload release. A shunt regulator is only useful for increasing speed above normal, but the series type reduces the speed and some types combined both these features.

Wellingborough. F. COOPER.

I WOULD like to assure Mr. K. Giles that I have tested and passed through hundreds of the face-plate starter-regulators mentioned, although admittedly some-time ago.

The usual starter arm had a fan-shaped heel with saw-cuts corresponding to the notches on the starter. The standard no-volt bobbin was used, but the armature was hinged so that a small steel extension engaged with the saw-cuts when the no-volt coil was energized. On the operation, however, of the overload or of failure of voltage the armature released its grip and the starter lever flew back to the off position under the influence of its control spring.

This was a very simple and cheap modification of standard starter parts which enabled the no-volt and overload protection to be given on all or any of the notches as desired, depending on the saw-cuts used.

"TIME LAG."

Trams and Buses

WITH reference to the proposal of the London Passenger Transport Board to replace its trams by Diesel buses, it would seem that the electrical manufacturing and supply industries, being in no need of extra custom at the moment, are prepared to allow one town after another to abandon electric street traction altogether without protest. This is rather short-sighted.

There seems to be no reason for the abandonment of the trams in London, as about half the cars could be made serviceable for another ten years at comparatively small expense, and the tracks are not excessively worn. Where abandonment is necessary, trolley-buses would in most cases be more suitable, particularly on those routes which had already been converted halfway in 1939, i.e., the Wandsworth routes, which it is apparently intended to operate by Diesel bus to Clapham Junction and Battersea, and by trolley-bus west of those points.

Most of the routes, however, have the frequent services and wide straight roads which most favour tramway operation. If really modern cars, similar to the latest models at Glasgow and Blackpool with resilient wheels and multi-notch control to give silent operation and high speed were tried, the prejudice against trams, inspired by the noisy forty-year old cars, which form a fair percentage of the present fleet, would soon disappear.

As for flexibility, this was one of the arguments for using Diesel buses in Coventry, but they still run on exactly the same routes as the former trams, with only one or two short extensions. Moreover, flexibility is of convenience to the operator, not to the travelling public, which would doubtless prefer to be carried in greater comfort and at lower fares.

"ELECTRANSPORT."

Heating by Valve Generators

Advantages and Main Applications

OUTSTANDING advantages of electric heating at radio frequencies are the elimination of waste in warming up furnace walls, containers and conveyors and the high speed of working. In the heat treatment of metals, the induced eddy currents employed as the medium are confined, owing to skin effect at high frequencies, to the surface of the material where the heat is generated. The depth of penetration varies with the metal and is considerably less for magnetic materials at room temperatures. For example at 1 Mc. per sec about 90 per cent of the current flows in a layer less than 0·02 in. thick.

Speed, inherent cleanliness and ease of control are especially advantageous in the annealing and tempering of small parts where the effect is localized or where the work is repetitive. Under average conditions 18 lb of non-magnetic metal or 40 lb of magnetic metal can be heated through 100 deg C per min. Except for certain small-scale or laboratory work, valve oscillators are not usually economical for melting. A much more favourable field is presented by soldering and brazing where high output is required, e.g., the seaming of tin cans, brazing of cycle frames and of tips to tools and the fixing of studs and handles. To raise half a pound of copper to a soft-soldering temperature would take about 15 seconds.

Surface Hardening

For surface hardening the process has the further advantages of eliminating scale (on account of the speed of operation) and of concentrating the heat where it is required (owing to skin effect). A typical example is that 10 sq in. of steel surface could be hardened to a depth of 0·03 in 5 to 10 sec. Selected zones may be treated without "blanking off." Since the core of the metal remains cool, distortion is usually negligible, so subsequent lapping or grinding is reduced or eliminated.

Dielectric heating is based upon the molecular disturbances created in non-conducting material separating two a.c. electrodes. The power absorbed appears as heat uniformly generated throughout the material, if homogeneous, varying in amount with its power factor and dielectric constant and increasing with frequency of applied voltage and voltage gradient. A limit is set to upper values of frequency since with its increase the efficiency of valve oscillators falls. From 80 Mc to 10 Mc presents a wide enough range for the large majority of purposes.

The main dielectric application is in jointing thermo-plastic sheets, for which rates of 10 ft per min or more are obtainable, while short joints can be made in a few seconds. In the pre-heating of plastics, ½ lb can be dealt with in 1 min per kW. In drying processes the total power varies with the moisture content : e.g., 1 kW will evaporate about 2·8 lb of water per hr from materials containing more than 50 per cent moisture and less as the moisture content falls, owing to the power required to heat the material itself. The gluing of timber joints is another process in which speed of operation brings considerable advantages; about ¾ lb can be raised through 100 deg C per min per kW of input.

The above particulars have been culled from a new 28-page brochure entitled "High Frequency Heating by Valve Generators," which has been compiled by the General Electric Co., Ltd. The numerous illustrations include a number of curves showing performance under various conditions. Details are also given of the range of generators available, from 0·1 to 25-kW, with estimates of what can be expected of each.

Wire Broadcasting

First Licensed Carrier-frequency Service in Britain

RELAYED broadcasting commenced in the United Kingdom about 1927. To-day about 270 " exchanges " are relaying the B.B.C. programmes to over 600,000 homes. Where these services are available, one in every three households chooses this means of listening and in some towns the density of relay subscribers is as great as 80 per cent of the householders; to-day every fifteenth licensed listener receives the B.B.C. programmes in this indirect way.

But these systems do not usually offer a choice of more than two programmes, since two distributing wires are needed for each, and the method is otherwise limited in scope by dependence upon the audio-frequency principle of distribution. The use of modulated carrier frequencies is now enabling 600 conversations to be simultaneously " guided " along a single pair of conductors in a P.O. telephone cable.

It was these facts which caused Multi-Broadcast (Engineering), Ltd., to request the British Thomson-Houston Co., Ltd., to develop and make carrier equipment to function on a different basis and commercial designs to be produced next year will cater for six programmes over two wires only.

Prototype at Rugby

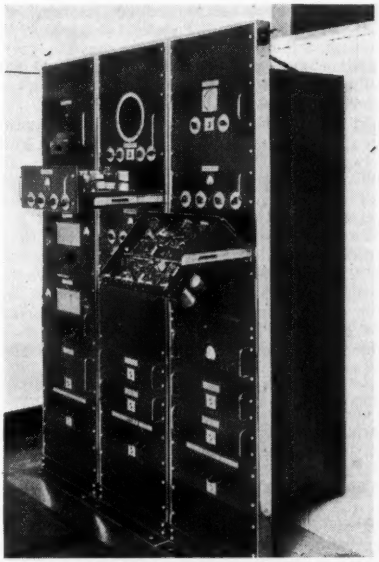
A four-channel prototype has served with complete satisfaction a normal residential area in Rugby for the past eight months. That installation was publicly demonstrated last week; it is the first of its kind in this country to be " officially approved " by the ceremonious handing over of the P.O. operating licence in the presence of senior representatives of the G.P.O., the B.B.C., civic dignitaries and a large company of guests.

The programmes to be relayed are preferably received by land line from the nearest B.B.C. regional studios for preservation of fidelity; otherwise aerial arrays terminate in high-quality communication radio receivers in a centrally situated station. There the carrier frequencies, specially selected to suit the locality, but all under 200 kc/s, are modulated by the incoming programmes and then pass through a mixer either by way of simple amplifying sub-stations or directly to the distributing network of feeders.

Each of the latter, designed to serve about 3,000 subscribers, generally consists of two 18 s.w.g. copper conductors covered with polythene. They are spaced about 2 in. apart on porcelain insulators carried by a metal bracket strapped to the chimney stacks along the backs of the houses. The overhead lines are specially balanced with respect to electrical " earth " and radiation in conformity with stringent P.O. requirements for non-interference with other means of communication.

A polythene-insulated two-core cable of small diameter forms the down-lead to the subscriber's reproducer, which is mains energized, the small cabinet containing both loudspeaker and selector. Two regulating knobs only are provided; one is a six-position snap-switch for selecting programmes and gramophone reproduction, while the other is a combined volume control and " on/off " switch.

It will be appreciated that the audio-frequency power available per subscriber is not limited by the system of distribution, while the carrier



Modulator panels for carrier-frequency multi-broadcasting at Rugby

frequencies and their spacings can be chosen without regard for anything but performance. The energy level and quality of the signal delivered to each subscriber is substantially constant, irrespective of distance from the source of transmission, length of relaying line or number of subscribers connected thereto. Thus reproducer design is simplified and an exceptionally good signal-to-noise ratio can be maintained, which results in remarkable freedom from interference caused by various household appliances.

Carrier-frequency relaying is claimed to be capable of a better standard of performance at

a lower cost than is obtainable by any comparable method. Thus the advantages expected from the future change-over of the B.B.C. to frequency-modulated short waves, which are likely ultimately to replace medium and long waves modulated in amplitude as used today, can be passed on to carrier relay subscribers without rendering their reproducers obsolete. Major adaption will be needed only at the central "exchanges," where the modulator panels have been designed for ease of accessibility to sub-assemblies. Full monitoring facilities are provided, including cathode-ray oscillographs as well as line-fault indicating equipment.

Progress in Ontario

Increasing Demand for Power

A REMARKABLE feature of the operations of the Hydro-Electric Power Commission of Ontario during 1945 was the growing demand for power despite considerable decreases in the war loads. The annual report, just received, states that the total peak output of power from all sources during the year ended October 31st, 1945, was 2,608,000 H.P., about 163,000 H.P. more than the maximum for the previous year. Total energy production was nearly 12,500 million kWh, approximately 450 million kWh more than in 1943–44.

In Ontario the average monthly consumption per domestic consumer is about 200 kWh and in two cities and one town the figure has exceeded 400 kWh per month. No fewer than ten towns had an average consumption of more than 250 kWh per month. The average cost per kWh to domestic consumers in the 300 urban municipalities operating their own hydro-electric undertakings was only 1·15 cents. Reductions in tariffs for domestic, commercial and power consumers during 1945, involved 255 municipal undertakings, the consumers of which will benefit by a total of over £3,300,000 per annum.

Intensive Planning

Operation on the whole was quite favourable during the year and no special trouble from ice-runs was experienced. Nearly 80,000 H.P. of generating capacity was added, about 60,000 H.P. in Northern Ontario and 19,000 H.P. in the Thunder Bay district, bringing the aggregate normal capacity of the Commission's generating stations up to 1,720,000 H.P. The year was, however, characterized by intensive planning rather than by active construction. Nevertheless certain major projects were authorized and in some cases work was started. In the Niagara Division of the Southern Ontario system the construction of a second unit at DeCew Falls was commenced during the summer of 1945. With a capacity of 70,000 H.P., under 280 ft head, the new unit will deliver its output to the Southern Ontario system. Its construction will extend over about two years and will cost approximately $7,700,000.

To meet the immediate growth requirements in Eastern Ontario a 54,000-H.P. development at Stewartville on the Madawaska River has been authorized and its construction has been commenced. The head to be developed at this site, is 150 ft. It will cost almost $9,000,000 and be available next winter. The new development, in head and capacity, is similar to that completed during the war at Barrett Chute higher up the same river.

Ottawa River Project

The third and most important hydro-electric development authorized during the year and destined to increase the power resources of the Southern Ontario system, is that of the Des Joachims site on the Ottawa River 40 miles upstream from Pembroke. The initial programme will comprise the installation of six units with a total capacity of 360,000 H.P. under a gross head of 135 ft, to be created by a dam across the river. Present plans call for the completion of the scheme in 1949. The estimated cost of the initial installation is $51,000,000.

Associated with these new generating plants at Stewartville and Des Joachims are important new transmission lines. From Stewartville to Oshawa a new 60-cycle transmission line costing $3,000,000, will be constructed to tie into Barrett Chute. To carry the power generated at Des Joachims transmission lines about 235 miles long will be required to deliver the power to distribution centres at Burlington and Islington. These will cost about $24,000,000. A third line from Oshawa west to Scarborough and thence northwards to Barrie will provide an important link between the Eastern Ontario and Georgian Bay divisions.

Radar Direction Finding

ONE of six papers constituting a symposium on radio direction finding arranged by the Radio Section of the Institution of Electrical Engineers dealt with the location of thunderstorms by this means. The paper, by MESSRS. F. ADCOCK and C. CLARKE, was an official communication from the National Physical Laboratory. It discussed the nature of the radiation from a lightning flash and showed that polarization errors were the main cause of the inaccuracy of the crossed-loop cathode-ray direction finder at present used by the Meteorological Office. Various ways of increasing instrumental accuracy and of improving the method of location was discussed and described.

COMMERCE and INDUSTRY

Pattern-Makers' Strike Averted.

NEGOTIATIONS between employers and the United Pattern-Makers' Association have resulted in an agreement which will prevent the strike of about 15,000 pattern-makers which had been threatened. It was considered by the men that there had been too long a delay on the employers' part in giving a decision after a conference held last June to consider complaints of disparities in rates between different areas of the country and sometimes in different shops in the same locality. A general rate of about 3s. an hour is aimed at.

Welsh Industries Fair

London is to see a Welsh Industries Fair for the first time. Opening on New Year's Day, 1947, and continuing until January 7th, the Fair, organized by the National Industrial Development Council of Wales and Monmouthshire, will be held at the Royal Horticultural Hall, Westminster. The scope of the exhibits will be very wide and will include a large proportion of consumer goods from the light industries now established in the Principality, such as domestic and office equipment, hardware, electrical fittings, hot-water systems, and saws and tools. Among exhibits of non-consumer goods will be switchgear, conveyors, drop-forging plant, marine engineering, and motor pistons.

Austin-Crompton Parkinson Vehicles

It was announced this week that the Austin Motor Co. and Crompton Parkinson, Ltd., have reached agreement for equal partnership in a new company to be known as "Austin-Crompton Parkinson Electric Vehicles, Ltd." The Austin Company says that this foreshadows a considerable expansion in the production of electric vehicles. The new company will take over the work formerly carried on by Crompton Parkinson through their associated companies, A. E. Morrison & Sons, Ltd., and Electricars, Ltd. The responsibility for the manufacture of electric vehicles and industrial trucks for the new company will be taken over by the Austin Motor Co.

Rubber Production and Consumption

The latest "Rubber Statistical Bulletin" (October-November, 1946) issued by the London Rubber Secretariat estimates that the production of natural rubber in the principal territories in September was 90,000 tons, raising the total for the first three-quarters of this year to 508,500 tons. This compares with an output of 240,000 tons for the whole of 1945. Consumption for the first eight months of the year is put at 265,000 tons, as compared with 210,000 tons in 1945. Stocks in the United Kingdom at the end of September are stated to have been about 156,000 tons.

Increased Rubber Consumption.

Synthetic rubber production in August was 70,125 tons (United States 64,309 tons). For the first eight months of the year it was 535,215 tons against 866,069 tons in 1945. Consumption for the eight months is estimated at 640,000 tons (845,000 tons in 1945).

Consumption of rubber in the United Kingdom cable industry in 1945 was: Natural 1,983 tons; synthetic 4,090 tons; total 6,073 tons. During the first eight months of the current year it was as follows:— Natural 3,312 tons; synthetic 2,634 tons; total 5,946 tons.

Copies of the Bulletin can be obtained (at 2s. each) from W. H. Smith & Son's branches.

Manufacturers Buy Helicopter

Erinex, Ltd., makers of "Cepco" electric kettles, in the picturesque Northamptonshire village of Flore, have recently acquired a helicopter for everyday business use.

Bulpitt's New Premises

When the Germans raided Birmingham on October 26th, 1940, they started a fire which destroyed all the offices and all the production of "Swan Brand" products of Bulpitt & Sons, Ltd. Part of the factory space, urgently required for essential war production, was rebuilt, but the office staff was accommodated until early November this year at a temporary address. New premises have now been opened at St. George's Works, Icknield Street, Birmingham, 18, which will increase the company's productive capacity.

Utilizing "Off-Peak" Periods

Saving of electricity by maximum use of "off-peak" periods is the theme of a nation-wide poster campaign sponsored by the British Electrical Development Association. Hoardings throughout the country are carrying 16-sheet posters exhorting the housewife to "Use Electricity at Off-peak Periods and Help to Avoid Cuts." Normal peak periods (8 a.m. to noon, 4 to 6 p.m.) are given on the posters, stickers being available for use where local peak periods occur at different times. Each poster illustrates one of the five main electricity-users—cooker, water-heater, fire, kettle, or iron.

Running concurrently with the poster campaign is a series of national press advertisements explaining the reason for the cuts, and how the consumer can help provide the solution by confining utilization to "off-peak" periods. Double-crown posters in local areas supplement the national campaign, which will be further

supported by local press advertising. It is planned to augment local campaigns later with leaflets and lantern slides. Member supply undertakings of E.D.A. are being supplied with service folders detailing the posters, stereos, etc., which will enable them to provide area support for the campaign.

Industrial Welfare Course

A two weeks' course for women industrial welfare officers will be held at the National Recreation Centre of the Central Council of Physical Recreation, Bisham Abbey, Berks, from January 11th to 25th. The course is open not only to women welfare officers as such, but also to employees in administrative and other departments who would benefit. Firms interested should communicate with the C.C.P.R., 58, Victoria Street, S.W.1. A fee of £10 10s. will be charged to cover tuition and full board-residence for the fortnight.

White City Auction Sale

A wide range of surplus goods will be offered at a Ministry of Supply auction sale at the White City next month. Included in the sale, which is one of a series of fifty which the Ministry of Supply intends to hold between now and March, will be over 2,000 lots of industrial equipment among them 1,500 accumulator trolleys and about 200 German petrol-electric generating units. Admission to the sale (which will be held from 10 a.m. daily between December 9th and 13th) and to the pre-view (December 2nd to 6th) will be by catalogue, available from the auctioneers, Chesterton and Sons, 116, Kensington High Street, London, W.8.

The British Council

Some idea of the wide range of the British Council's activities is imparted by its 178-page report for 1945-46 just published. In general the object of the Council is to acquaint other countries with all aspects of British life and this is generously interpreted to cover cultural, technical, scientific and popular subjects among others and many different media are employed.

One of the Council's activities is the circulation to overseas journals of articles appearing in the British Press, an arrangement in which the *Electrical Review* has participated. Institutes have been set up in many foreign centres, in some of which, among other matters, engineering classes have been arranged.

During the year a two-week course in advanced electrical engineering was held for British Council and other students at Queen Mary College (University of London) the object being to present to foreign engineering students an adequate picture of British electrical engineering achievements. Among scholarships awarded during the period under review were those offered by the Council in conjuction with the Metropolitan-Vickers Electrical Co., and the English Electric Co. A scheme financed by the Council, jointly with C. A. Parsons & Co., and A. Reyrolle & Co., for Turkish engineering apprentices was continued.

Bolton Engineer's Salary

The Minister of Fuel and Power, Mr. E. Shinwell, has declined to intervene in the dispute regarding the salary to be paid to Bolton borough electrical engineer and manager. He has told the Bolton Electricity Committee that the matter does not appear to be one in which it would be proper for him to intervene.

Ericsson's Sunderland Factory

Ericsson Telephones, Ltd., which started business at Southwick, Co. Durham, about two months ago, is now employing 200 workers and by next spring hopes to have 800 girls and 100 men employed.

"The Architect & Building News"

The *Architect & Building News* has been acquired by Associated Iliffe Press. This old-established journal, which incorporates *The Architect*, founded 1869, and *Building News*, founded 1854, will continue to be edited by Mr. W. L. Wood and the entire staff will retain their positions. The administrative, publishing and advertising offices have moved to Dorset House, Stamford Street, London, S.E.1. The editorial department, for the time being, will remain at 2, Bream's Buildings, London, E.C.4.

Metway Electrical Extensions

An extension of the factory of Metway Electrical Industries, Ltd., at King Street, Brighton, was recently formally opened by Mr. D. G. E. Barrie, managing director, who in addressing employees mentioned that in the year under review (1945-46) the company had been able to increase the bonus to employees from 10 per cent to 15 per cent. Mr. D. W. McEwan, general manager, replied on behalf of the staff. The lighting of the factory extension is fluorescent and the installation was carried out by Page & Miles, Ltd.

Television at Birmingham

Plans which are expected to provide the Birmingham area with television broadcasts within the next two years were referred to by Mr. H. L. Kirke, head of the Engineering Research Department of the B.B.C., in the course of a lecture on "Television" delivered to members of the English Electric Engineering Society at Stafford on November 20th.

Mr. Kirke said that proposed sites had already been inspected just north of Birmingham and that they were about to invite tenders for the transmitter. The mast would be 500 or 750 ft high and the job will take two years. The cost of television programmes being ten times that of sound programmes, the only economically

possible way was for all transmitters in the country to radiate the same programme. Distribution was a difficult problem. The Post Office was working on a cable to carry programmes to Birmingham and experiments were also being carried out with radio links. The two would be tried side by side.

Reports on German Industry

Among the latest reports upon German industry prepared by British and Allied investigating teams are the following:—F.I.A.T. 102. "New Radial Flow Turbine Design" (1s.). F.I.A.T. 376. "Quadrant Type Electric Steering Gear for the German 5,000-ton and 9,000-ton Hansa Ship Programme: also other Electric Steering Gear" (1s. 6d.). F.I.A.T. 512. "Survey of Low Voltage, Air Circuit Breaker Practice, Germany" (3s.). F.I.A.T. 609. "High Power Radar Jagdhaus" (1s. 6d.). F.I.A.T. 786. "The Lithium Electrolytic Cell" (Degussa, Rheinfelden) (1s.). B.I.O.S. 724. "Electronic Principles as Applied in Germany to the Testing of Materials" (16s. 6d.). A few copies of these reports are available from the Stationery Office at the prices shown.

Philips Lamp Works

The present activity of the Philips Incandescent Lamp Works, Holland, is estimated to be at the rate of 85 per cent of pre-war capacity, a figure which, it is hoped, will be increased to 127 per cent in 1947. The Dutch factories are employing at present 27,500 people, of whom more than 21,000 are at the Eindhoven plant. Philips now have twenty-six factories in other countries, in addition to forty-four foreign sales organizations.

Exports in 1946 are expected to reach about 65 per cent of pre-war (on a comparable price basis).—*Reuter's Trade Service* (The Hague).

"Hoovergrams"

The first issue of a quarterly magazine has just been issued by Hoover, Ltd., with the title of "Hoovergrams." The publication is intended to keep Hoover dealers informed of the company's plans and to assist them in their sales of vacuum cleaners. It includes articles on what dealers should know, current Hoover advertising and a map of Great Britain showing the company's divisions and branches.

Australian Manufacturing Plans

In the *Industrial Australian* a list is given of twelve electrical manufacturing concerns which have taken over the whole or part of factories built during the war for munitions production. They include Electricity Meter & Allied Industries (part of factory at Orange, N.S.W., for electrical and electronic products); the Australian General Electric (part of factory at Villawood for motors and associated equipment); Standard Telephones & Cables (also Villawood, for radio, electrical and associated equipment); Vactric (part of Finsbury, S.A., factory for vacuum cleaners and accessories) and Phillips Electrical Industries (Hendon, S.A., factory, for electrical and radio equipment). Other concerns are manufacturing household refrigerators and other domestic appliances, motors, transformers and electronic apparatus.

Northampton Electrical Association

"X-rays" was the subject of a lecture given by Mr. R. G. Mitchell, physicist at the Northampton General Hospital, to the Northampton & District Electrical Association, at the College of Technology, on November 13th.

Lamp Publicity

Included in the new window display material which the Metropolitan-Vickers Electrical Co., is issuing in connection with the "Cosmos" lamp campaign, is a display designed especially for large windows. This opens to an overall width of approximately 9 ft and stands 4 ft high.

Gauge and Tool Makers

The next in the series of luncheons which the Gauge and Tool Makers' Association is arranging for its members and their guests will be held at the Savoy Hotel, London, on March 11th, 1947. The guest of honour and chief speaker will be Lord Woolton.

Five-day Week

Grampian Reproducers, Ltd., are adopting a five-day week as from December 14th, and their works and offices at Hampton Road, Hanworth will therefore be closed on Saturday mornings.

With reference to the notice in our issue of November 15th regarding the adoption of the five-day week by William McGeoch & Co., Ltd., the company asks us to make it clear that it is only its Birmingham works that is working a five-day week. The head office and workshop in Glasgow continue to operate a 5½-day week.

Dissolution of Partnership

Messrs. F. Hollinghurst, D. P. Woodstock and R. Bulbick, carrying on business as electrical and radio engineers at 712, Christchurch Road, Boscombe, Bournemouth, as Edwards & Co., have dissolved partnership. Mr. Hollinghurst will attend to debts and carry on the business under the style of Edwards & Co.

Trade Publications

Evershed & Vignoles, Ltd., Acton Lane, Chiswick, London, W.4.—New edition (No. 210), printed in Russian, of the illustrated pocket-book on insulation testing explaining the principles and uses of the "Megger" insulation meter.

Imperial Chemical Industries, Ltd., Kynoch Works, Witton, Birmingham, 6.—Two illustrated brochures dealing with "Kutern" copper,

which is more easily machinable at high speed to a fine surface finish; and with "Kumium" chrome-copper alloy, which retains its tensile strength, hardness and conductivity at high temperatures.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17.—Illustrated leaflet (501/4-1) describing the full range of jet propulsion engines for aircraft.

Muirhead & Co., Ltd., Elmers End, Beckenham, Kent.—Illustrated and priced leaflet (B.569.B) describing a direct-reading pH meter.

Standard Telephones & Cables, Ltd., Connaught House, Aldwych, London, W.C.2.—Two leaflets respectively concerned with telemetering and staff locating systems.

Dawe Instruments, Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex.—Illustrated leaflet describing the "G" meter for measuring the degree of shock caused by violent movement.

Amplec, Ltd., Grange Works, Accrington.—Loose-leaf brochure with price list of a range of household wash-boilers, round and rectangular, enamelled and galvanized.

Electrolux, Ltd., 153, Regent Street, London, W.1.—Illustrated "Builders' Bulletin" published periodically to provide information appertaining to the installation of refrigerators in flats and small houses.

Pye, Ltd., Radio Works, Cambridge.—First number of "The Circle," a little magazine dealing mainly with Pye products and associated matters, circulated to the company's agents.

Frank Whitelegg, 90, Robin Hood Lane, Sutton, Surrey.—Leaflet (list CA) on revolution counters.

J. E. Sexton & Co., Ltd., 164, Gray's Inn Road, London, W.C.1.—Illustrated folder on household fires, irons, hand and desk lamps.

Education for Industrial Employees

A residential college at Holly Royde, West Didsbury, Manchester, was used during the war for giving short courses for Service men. As this arrangement is now coming to an end the Department of Extra-Mural Studies of the Manchester University, of which Mr. R. D. Waller is director, is commencing a series of weekly or fortnightly courses in non-industrial subjects for employees of industrial concerns in the area. Mr. Waller has appealed for the co-operation of employers, asking them to allow employees to attend the courses without loss of pay. Among the concerns which have responded are the Metropolitan-Vickers Electrical Co., Ltd., and Ferranti, Ltd.

World List of Scientific Periodicals

Preparations are being made for the issue of a third edition of the *World List of Scientific Periodicals*. The last edition issued in 1934, and covering the years 1900-1933, contained over 33,000 titles of journals and included the holdings of some 180 libraries in Great Britain and Ireland. The new edition, will include all the scientific and technical periodicals that appeared during the period 1900-1947 as well as the holdings of additional libraries. Librarians are being asked to co-operate by sending particulars of all those journals on their shelves that do not appear in the second edition or are shown there as having no location in this country, to the secretary, World List of Scientific Periodicals, c/o The Zoological Society of London, Regent's Park, London, N.W.8.

Nationalization Poster

The Electrical Trades Union has sent us a poster which it has designed as a contribution to the campaign for the nationalization of the electricity supply industry. The poster, which is in three colours, illustrates a transformer, and is worded "Transform the Nation's Electricity Supply Services: A Nationalized Industry will Serve the People." It is being displayed in the Underground stations of the London Passenger Transport Board and copies are being distributed to the affiliated bodies of the Trades Union Congress and the Labour Party through the headquarters of those organizations. It is also being sent to associations likely to be directly interested through their relationship with the electrical industry.

Orders for Spain

According to the *Manchester Guardian* strong feeling among employees of the Metropolitan-Vickers Electrical Co. against working on orders for Spain has led them to seek union support for a proposal to refuse work on such orders while British contracts are waiting to be filled.

German Lamp Production

It is reported by *Reuter's Trade Service* that the Berlin factory of the Osram Gesellschaft is now producing about 800,000 lamps a month. Its pre-war output was between five and six million monthly.

Lighting in Mines

At a meeting of the West of Scotland Branch of the Asscciation of Mining Electrical and Mechanical Engineers at Glasgow, MR. S. W. RICHARDS spoke of "Lighting in Hazardous Situations," and exhibited a type of lamp which, he explained, had been specially designed for work at the coal face. It could be plugged in quickly and was suitable for rapid assembly.

Popular Science

In the form of a weekly news-letter, *Science To-Day* (104, Clifton Hill, N.W.8) is intended primarily for the general reader. Sober in tone and not neglecting fundamental aspects, its general tendency should be to stimulate a wholesome interest in natural phenomena and to correct popular fallacies regarding what is possible or probable in scientific development. In each of the first four numbers half a

dozen topics are dealt with, such as atomic perspective, gas turbines, radio-valve calculating machines, measurement by wave length and the electron and recommendations of books.

Institute of Marine Engineers

The next examinations for admission to the Institute of Marine Engineers will be held in 1947 as follows:—Students, April 15th to 18th and October 7th to 10th; graduates, May 12th to 16th; associate members, May 12th to 19th. Syllabuses of these examinations, copies of previous papers, and particulars of exempting qualifications may be obtained on application to the Secretary, Institute of Marine Engineers, 85, Minories, London, E.C.3.

Westinghouse Domestic Appliances

We are informed that the correct name of the agents handling spare parts and service for Westinghouse domestic appliances is the Refrigeration Services (South London) Co., 40, Upper Richmond Road, Putney, S.W.15 (telephone: Putney 2058) and not as stated in our last issue. Inquiries for new Westinghouse products of U.S.A. origin are handled by the Westinghouse Electric International Co., 1-3, Regent Street, London, S.W.1.

Trade Announcements

The London Electric Wire Co., and Smiths, Ltd., and its associated companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and Vactite Wire Co., Ltd., have appointed Campbell, Gardner & Co., 27, Franklin Street, Belfast, as their sales representative for Northern Ireland.

Artlang, Ltd., electrical wholesalers of 42, Langham Street, London, W.1, state that their permanent address is 42, Langham Street, London, W.1, and their telephone number is Museum 6677. A proposed move into new premises, now cancelled, led to the insertion of the new address and telephone number in the telephone directory.

TRADE MARKS

THE following applications have been made for the registration of trade marks. Objections may be entered within a month from November 20th:—

OAK. No. B638,865, Class 9. Vibrator and switches being components and parts of radio sets.—Oak Mfg. Co., 1260, Clybourn Avenue, Illinois, U.S.A. Address for service: c/o A. A. Thornton, Napier House, 24-27, High Holborn, London, W.C.1.

TRIXADIO. No. 642,634, Class 9. Electrical apparatus and instruments included in Class 9; scientific, cinematographic and teaching apparatus and instruments, talking machines, etc.—Trix Electrical Co., Ltd., 1-5, Maple Place, Maple Street, Tottenham Court Road, W.1.

FRIGERETTE. No. 641,439, Class 9. Refrigerating installations and parts thereof not included in other classes.—Boyd, Ltd., 81, Peckham High Street, London, S.E.15.

HOLOFLUX. No. 643,123, Class 11. Lighting installations.—Holophane, Ltd., Holophane House, Elverton Street, Vincent Square, S.W.1.

AGILUX. No. 643,282, Class 11. Lighting fittings.—Aeronautical & General Instruments, Ltd., Purley Way, Croydon.

TOREX. No. 643,334, Class 11. Electric toasters.—Michael Curry, 2, Chelmsford Square, London, N.W.10.

London J.E.A.

AMONG matters which were to come before the London and Home Counties Joint Electricity Authority at its meeting yesterday (Thursday) were the following:—

RECRUITMENT OF STAFF.—In June last the J. E. A. adopted the scheme of conditions of service of the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services. The General Purposes Committee reports that the N.J.C. has only recently appointed a Local Government Examinations Board whose plans have yet to be made, and recommends interim arrangements for the selection of candidates for recruitment to the junior staff. It is proposed that grants of £15 and £30 respectively shall be made to officers who pass the intermediate and final examinations of recognized official institutions unless such certificates are a condition of appointment. The observations of the District Joint Works Committees are to be requested on matters relating to training.

POWER SCHEMES.—The Technical Committee reports that the London Power Co. has applied to the Electricity Commissioners for consent to the installation of two 22-kV transmission lines from the Battersea generating station to the company's distributing station in Horseferry Road. The cost, with switchgear and transforming equipment, is estimated at £100,000. Notification has also been received of the City of London Electric Lighting Co.'s application for sanction to extend its Bankside generating station by two 50,000-kW sets.

MAINS EXTENSIONS.—The Local Distribution Committee of the J.E.A. has approved extensions of mains and services costing £26,408.

BORROWING POWERS.—An explanatory note on the Joint Electricity Authorities (Borrowing Power) Regulations, 1946 (S.R. & O., 1946, No. 1652) is submitted by the Finance Committee. Under the 1926-1931 Regulations Joint Electricity Authorities were able to borrow temporarily, from a bank or otherwise, with the consent of the Commissioners, the maximum period of borrowing in this manner being twelve months. Under the amended Regulations this period may be extended, and the requirement for repayment out of money subsequently borrowed on mortgage, etc., is deleted.

Colour-Light Signals

Brighton Line Scheme

WITHIN three weeks of the announcement of the plan involving £15,000,000 expenditure on electrification and Diesel traction, the Southern Railway directors have approved a scheme costing £1,200,000 for multiple aspect colour-light signalling for the London and Brighton main line. The installation will be carried out in four stages, taking five years to complete, and will include displacement of thirty-two manually operated signal boxes by eleven which will be power worked. An annual saving of nearly £20,000 in expenditure will result.

The greater part of the route from London to Brighton is already equipped with colour-light signalling, but on the suburban sections from Battersea Park and New Cross Gate to Coulsdon North the earlier type of semaphore signalling is still used. It is these inner London sections that the scheme covers. A greater number of signal sections will be introduced, increasing track capacity. Intervals between trains on certain sections will be reduced from three to two minutes, and a greater frequency will be possible. During fog, 70 per cent or more of the normal train service can be guaranteed, instead of about 40 per cent as to-day. The Southern Railway has already the largest mileage of track controlled by colour-light signals in the country, 405 track miles being so equipped. The latest additions cover a further 98 track miles, including many complicated junctions.

Swedish Plant for Russia

Manufacturers' Doubts

IT was recently announced that a trade and credit agreement had been signed by Sweden and Russia. According to the *Anglo-Swedish Review*, the most important orders for Swedish plant include water turbines, generators and equipment to the extent of 265,000 kW, complete steam power plant totalling 250,000 kW, general electrical equipment to the value of kr. 47 million and mining equipment to the value of kr. 200 million.

Russian deliveries to Sweden will include chromium and manganese ore, iron and petroleum products.

The *Review* says that certain apprehensions have been expressed in the Swedish Riksdag regarding the size of the credit (kr. 870 million) and because considerable expansion, particularly in the electrical industry, will be required to meet the Russian orders, " the various firms being already booked to capacity for the next few years, while nobody can tell whether the new investments required will not prove uneconomic in the long run."

A section of the press has attacked the Minister of Commerce, Professor Gunnar Myrdal on account of the methods he is said to have employed in order to make industrialists fall into line with his proposals. The Minister is alleged to have threatened the managing director of A.S.E.A. (Mr. Ericson) with nationalization or the establishment of " State-supported foreign competition " if the necessary expansion was not undertaken.

In reply to this an official statement was made to the effect that the question had been raised whether increased production could be obtained by the expansion of existing undertakings, with a Government guarantee against loss, or by the establishment of a new State-owned undertaking or possibly the giving of facilities to some foreign concern which might wish to establish a subsidiary undertaking in Sweden. It was agreed, the statement says, that the last two alternatives were out of the question on account of labour and material difficulties. Mr. Ericson is said to have concurred in this view and to have stated that he did not wish to consider a Government guarantee. His board had decided to enter upon an expansion scheme which would meet the requirements.

Modern Cable Practice

Laying Methods Described

LAST week's joint meeting in London of the Association of Supervising Electrical Engineers and the Institution of Engineers-in-Charge was their twenty-first annual combined gathering.

It was addressed by MR. J. R. HARDING on present-day cable practice. After differentiating between types and briefly indicating methods of manufacture, he turned to mechanical methods of laying. The use of cable ploughs was a cheap method that effected large savings in labour, being most suitable for clear open sites where the subsoil was known to be firm and clear of obstructions. When large trenches were needed for high-voltage cables, large mechanical excavators were not usually economical owing to heavy standing charges and the difficulty of avoiding standing time. But small mechanical excavators drawn by ordinary agricultural tractors were proving to be economical for laying 11-kV cables in rural areas. A small " dozer " could usually perform the reinstatement work.

There was an economic field for aerial cables intermediate between overhead lines and underground cables. They were well established in America, but had made little progress here apart from Post Office use for pilot and telephone circuits. Methods and suspension and binding to catenary wire were described at some length, including self-supporting types of aerial cable.

Rubber and plastic insulating substances were mentioned, as well as such special purpose products as trailing cables, flame-retarding types and p.v.c.-tube cables.

Overseas Electrical Trade

October Exports Well Up

DURING October exports of electrical goods and machinery from this country reached a value of £5,540,718, nearly three times that recorded for the corresponding month of last year and more than thrice the monthly average for 1938. Practically every item showed a substantial advance in both comparisons. As will be seen from Table I, the outstanding item was radio apparatus which, at £855,419, was about four and a half times the 1938 monthly average. The principal customers for this equipment were British India (£193,770), South Africa (£81,952) and, among foreign countries, Norway, Sweden and Denmark.

X-ray equipment showed the greatest proportional increase—no less than 4,138 per cent. Several items were 400 per cent higher than the pre-war monthly average. Telegraph and telephone apparatus was exported to the extent of £532,683, as compared with a 1938 monthly average of £242,716. Leading customers were Russia (£164,437), South Africa (£75,026) and Australia (£76,860).

Exports of the cable class, as a whole, were valued at £894,820, against a monthly average of £359,881 in 1938. In the non-submarine telegraph and telephone section South Africa was the leading buyer, taking about a third of the total. British India was the chief importer of rubber-insulated cables (£75,355), with South Africa (£43,269) second and New Zealand (£24,622) third. For cables with insulation other than rubber the largest customers were South Africa (£94,316), British India (£46,933) and Australia (£32,477).

Table II shows that in the electrical goods

TABLE I.—ELECTRICAL EXPORTS AND IMPORTS

Class	Exports			Imports		
	October, 1946	October, 1945	Monthly Av., 1938	October, 1946	October, 1945	Monthly Av., 1938
	£	£	£	£	£	£
Telegraph and telephone wires and cables, submarine	21,854	68,460	17,289			
Ditto, not submarine	163,909	192,543	71,803	3,113	18,021	31,246
Wires and cables, other than telephone and telegraph, rubber insulated	307,655	90,876	117,533			
Ditto, insulation other than rubber	401,402	145,799	153,256			
Radio apparatus	855,419	195,792	149,593	1,341,313	506,076	75,160
Telegraph and telephone apparatus, other than radio	532,683	220,353	242,716	1,346	23,619	9,243
Electric carbons, furnace	*	*	*	—	84	4,054
Other electric carbons	*	*	*	5,517	3,924	2,301
Electric lamps	138,549	96,088	49,440	1,445	1,779	10,265
Other lighting apparatus	250,593	59,090	48,565	2,444	5,837	38,662
Primary batteries	38,379	14,347	13,572	853	1,594	3,549
Accumulators, portable	126,367	28,824	28,874	*	*	*
Ditto, stationary	16,600	3,502	19,773	*	*	*
Ditto, parts and accessories	55,197	24,110	*	*	*	*
Electric cooking and heating apparatus	151,689	30,156	30,664	*	*	*
Commercial electrical instruments, including ammeters, voltmeters, etc., and parts	78,219	28,398	15,878			
House service meters	66,360	18,258	15,791	2,782	5,923	32,057
Other electrical instruments	57,079	10,661	9,612			
X-ray apparatus, vacuum tubes and parts	206,845	15,554	4,881	22,239	3,387	9,734
Insulating materials, not elsewhere specified	136,742	51,621	19,343	*	*	*
Unclassified electrical goods and apparatus	416,409	193,877	110,615	12,944	147,290	42,630
Generators, complete, up to 200 kW	115,927	16,442	38,071	*	*	*
Ditto, over 200 kW	228,342	30,433	119,079	*	*	*
Ditto, parts	33,863	—	—	*	*	*
Motors	301,340	132,153	145,045	1,399	14,950	1,399
Convertors and transformers	260,447	58,489	101,304	*	*	*
Rectifiers for power-house use	17,203	9,285	3,463	*	*	*
Motor starting and controlling gear	78,641	49,306	50,866	*	*	*
Switchgear and switchboards, other than telegraph or telephone	304,734	88,415	184,533	*	*	*
Other electrical machinery	20,590	9,905	15,497	4,576	17,706	14,455
Electric vacuum cleaners and parts	101,352	17,503	26,662	123	43	7,519
Other electrically-operated portable appliances and parts	56,029	13,748	10,394	2,488	1,560	17,108
Total	5,540,718	1,913,988	1,814,114	1,402,582	751,793	324,016

* Not classified separately.

and apparatus section British India was responsible for a share of £636,845, over five times the pre-war monthly average. Next in order came South Africa (£598,447, against £157,602), Russia (£331,196, half of which was telegraph and telephone apparatus), Australia (£210,403) and British Malaya (£202,291). Eire, New Zealand, Belgium, France and Egypt were all above the £100,000 mark.

Machinery exports did not increase to the same proportional extent as shipments of goods and apparatus. At £1,361,087 they were just over double the pre-war monthly average; the increase was fairly evenly spread over the various classes. In the generator section the outstanding item was £171,108 for Russia (out of a total of £378,132). South Africa (£31,572) and British India (£40,809) were also important buyers. So far as motors were concerned, something over a fifth of the total (£64,549) went to British India, with South Africa (£52,675) and Australia (£20,772) second and third respectively. Russia was an outstanding purchaser of unclassified machinery (including switchgear); that country's share was valued at £137,245, against the 1938 monthly average of only £2,998. The leading buyers in this section were South Africa (£157,683) and British India (£149,409).

On the import side there was a sudden upward movement which was due entirely to heavy purchases of radio equipment from Canada; all other items were substantially below the pre-war values. The sources of imports of electrical goods and apparatus were as follows:—Canada, £1,315,106; other British countries, £1,530; Switzerland, £4,950; United States, £39,313; and other foreign countries, £33,097.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL GOODS AND APPARATUS

Destination	October, 1946	October, 1945	Monthly Av., 1938
	£	£	£
Eire	125,179	39,150	37,562
Channel Islands ..	43,321	18,048	11,965
Palestine	88,375	29,465	8,371
British West Africa ..	28,410	32,939	12,864
Union of South Africa	598,447	237,766	157,602
Southern Rhodesia ..	32,413	9,001	9,574
British East Africa ..	29,172	14,125	7,830
British India ..	636,845	178,221	122,928
British Malaya ..	202,291	—	32,280
Ceylon	19,446	8,973	14,931
Hong Kong	37,841	—	12,874
Australia	210,403	270,381	196,823
New Zealand ..	122,814	79,249	95,851
Canada	22,992	114,075	12,482
British West Indies ..	26,162	9,347	12,887
Other British Countries	82,205	42,260	26,336
Soviet Union ..	331,196	—	36,780
Finland	26,411	—	5,824
Sweden	64,689	3,336	13,735
Norway	95,451	22,235	12,582
Denmark	72,688	36,562	18,282
Poland	30,794	4,094	9,626
Netherlands	74,555	29,096	20,190
Belgium	140,745	8,195	10,874
France	104,346	1,729	15,674
French West and Equatorial Africa ..	1,512	1,709	400
Switzerland	19,300	1,367	3,572
Portugal	43,312	42,347	6,498
Portuguese East Africa	5,830	959	6,924
Spain	5,166	23,401	3,808
Italy	1,473	285	5,659
Czechoslovakia ..	7,212	—	7,205
Yugoslavia	13,227	—	1,471
Greece	30,948	32	4,888
Roumania	—	—	13,350
Turkey	52,886	6,308	7,633
Egypt	130,038	64,296	12,872
Iraq	40,202	7,895	5,456
Iran	44,705	55,504	16,330
China	68,446	8,070	4,042
United States ..	12,910	5,568	5,546
Chile	14,250	1,381	6,635
Brazil	20,161	7,374	11,123
Argentine Republic ..	67,207	30,750	45,387
Other Foreign Countries	195,984	42,816	33,672
Total ..	4,021,960	1,488,309	1,119,200

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Electricity Distribution

Conservative Party's Policy

WE have received from the Conservative and Unionist Central Office (Abbey House, Westminster, S.W.1) a booklet (price 9d.) containing a report on the retail distribution of electricity which was originally produced by Mr. Hugh Molson, M.P., and other members of the Tory Reform Committee. This, as with other documents of its kind, briefly surveys the history and present position of electricity distribution and the various reports which have been made on the subject and makes the following recommendations:—

The Electricity Commissioners should be responsible for the preparation of reorganization schemes designed to reduce the number of undertakings and to establish unified supply areas, and they should be given powers to impose a time limit within which the schemes are to become effective. If they are not carried out within the specified time the Commissioners should have power to impose the schemes. Terms of compensation for the acquisition company and municipal undertakings should be defined.

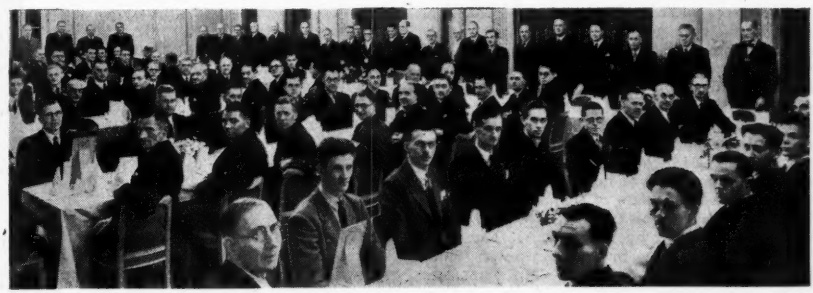
The Commissioners should have the duty of preparing development schemes for any areas in which they consider this necessary with power to enforce them if they are not carried out within a specified time. Similar provisions should apply to change-over and voltage standardization schemes.

The Commissioners should be responsible for the introduction of standard forms of domestic tariffs and fix maximum prices for the various districts. The existing prohibition of undue preference to any particular consumer should be retained.

I.E.E. at Liverpool

Electrical Industry and Increased Production

MERSEY and North Wales Centre of the Institution of Electrical Engineers held its annual dinner at the Adelphi Hotel, Liverpool, on November 18th, within a few hundred yards of which Mr. V. Z. de Ferranti (president, I.E.E.) said that his father, Dr. Ferranti, was born. MR. R. VARLEY (chairman of the Centre) expressed the hope that the premises, 132, Bold Street, would be identified by a plaque.



At the Mersey and North Wales Centre dinner

Proposing the toast of the Institution, PROFESSOR G. E. SCHOLES, commented that electricity suppliers were the only purveyors of a commodity to insist on knowing beforehand how that product would be used before they would state the cost. Consumers were puzzled by charges that were different because the electricity passed through different meters. After referring to the intimate relations between electrical engineering and the universities, Professor Scholes said electrical engineering had had more than its share of Press publicity recently.

MR. V. Z. DE FERRANTI said that electrical engineers and electrical engineering could do much more to increase production than the little extra called for from the worker. More power must be made available to men and women of the country to enable them to produce more, thus enabling exports to be increased and in the fullness of time allowing a reduction in the working week. At its present rate of growth, membership of the I.E.E. by about 1990, when the main electrification work would be completed, should be something like 200,000. The I.E.E. had 54 technical committees and next spring intended to have conferences on radio communication and servo-mechanisms.

MR. O. C. WAYGOOD referred to the existence of about twelve large ratepayers in the central area of Liverpool who had boiler-house chimneys that contributed to the pollution of the atmosphere, whereas, he considered, one boiler-house could supply all the heat and steam required by the surrounding industries.

The LORD MAYOR OF LIVERPOOL (Alderman W. G. Gregson) said that if Government control must come, then citizens in a democratic country had no option but to accept the edict, but it was a duty to see that the electrical industry did not suffer by the change. The industry had perhaps the biggest contribution to make to increased production and thus to help Britain to regain her pre-eminence.

MR. J. CORMACK proposed the health of the chairman who briefly replied.

Sanctioned Loans

FROM the Electricity Commissioners we have received particulars of loans sanctioned by them during the period from April 1st, 1944, to September 30th last. These show that during the six months from April to September this year there was greatly increased activity on the part of public authorities. The total amount approved by the Commissioners was £27,231,027, which compares with £37,652,375, for the whole of 1945-46 and £28,337,818 for 1944-45. Generating plant (£13,759,477) was the principal item and coupled with it was a sum of £4,855,043 for buildings. Distribution plant and buildings together accounted for £3,669,129, and mains and services for £3,977,165. Other leading items were meters and instruments (£274,987) and apparatus (£255,485). There was a substantial rise, to £63,942, in the amount sanctioned in respect of wiring installations; it was only £16,009 in 1945-46.

No borrowing by the Central Electricity Board was sanctioned during the six months.

PARLIAMENTARY NEWS

By Our Special Reporter

IN the House of Commons last week, Lt. Col. Kingsmill asked the President of the Board of Trade, how many of the 140,000 poles at present held by his department were suitable for electricity purposes.

Mr. Belcher said that there were about 30,000 held in stock by the Post Office.

Emergency Equipment

Mr. P. Freeman asked the Minister of Fuel and Power what amount of the electrical equipment and duplicate machinery now standing in docks in South Wales, which was stored for use in emergencies had been sold abroad; and how it was proposed to dispose of the remainder.

Mr. Shinwell said that this plant was part of a reserve pool which was built up for war emergencies. Much of it was unsuitable for regular use as plant of normal design. It was now being sold. Some of it had been bought by undertakings in this country, some by foreign countries and some by U.N.R.R.A. The plant which was now lying in docks in South Wales had been sold to U.N.R.R.A. No plant was being sold abroad which could be used to relieve the shortage in this country.

The "Ipsophone"

On November 20th, Colonel J. Hutchison, asked the Assistant Postmaster General, when he proposed to make "Ipsophone"* attachments to telephones available to subscribers in this country; and on what terms.

Mr. Burke said that the possibility of introducing facilities on the lines of the "Ipsophone" was being borne in mind, but for the present the resources of the Post Office must be concentrated on meeting the heavy demands for the provision of basic services.

Debate on the Address

The Debate on the Address in reply to the King's Speech was continued on November 20th, when Mr. Harold Macmillan moved an amendment on behalf of the Opposition submitting that the Speech contained no practical proposal for increasing production and expressing the view that the proposed further measures of nationalization would confuse and retard recovery. Mr. Macmillan said that nobody seriously believed that the present Government control of the electricity distribution industry was insufficient to preside over any developments that might be necessary. The assumption of ownership would do nothing but introduce delay. Nor could the inflationary effect of these nationalization schemes be denied.

In his rejoinder, the Lord President of the Council (Mr. Herbert Morrison) contended that members of the Conservative Party had expressed themselves in favour of socialization of transport and electricity distribution on previous occasions. He raised a strong protest from Mr. Churchill when he suggested that Mr. Churchill should confer with his friend Mr. Lyttelton "to get a little less restrictionism in the electrical plant manufacturing industry, a little less price restriction, a little less of quotations of tenders at exactly the same price." Mr. Lyttelton said that Mr. Morrison was mistaken if he suggested that there was any restriction of production other than that imposed by the Government.

Later in his speech Mr. Morrison maintained that the public ownership of electricity supply was a matter of common sense. He could not conceive that it would do other than improve the condition of the industry and the service to the nation, particularly in rural and sparsely-populated areas. He recalled that a Conservative Government had been forced to set up the Central Electricity Board to deal with the generating side. The case for the public ownership of gas had been made most effectively by a committee appointed by the Coalition Government.

Among subsequent speakers were Major C. Poole, who contended that only under nationalization would the rural areas be properly served, and Mr. Hobson, who said that it was envisaged from the earliest days of electricity supply that the industry should ultimately become publicly owned. He pointed to the success which had attended the establishment of the grid system and said that technical staffs were now in the position of having to serve two masters. He referred to differences in charges in different areas and claimed that companies' prices were always higher than those of local authorities.

Speaking in the resumed debate on November 21st, Mr. A. M. F. Palmer expressed the opinion that the organization of the distribution side of the electricity supply industry was an urgent matter. About 600 separate undertakings could not cope with the problems of standardizing systems and tariffs. He believed that the nationalization of the industry would promote increased efficiency and the lowering of charges. The workers, technicians and engineers in the industry were in favour of national ownership. It was opposed only by the companies and the Tory Opposition.

Mr. Marples said that so far as he could see the Government's planning allowed for an abundant supply of electrical apparatus such as kettles and no supply of electric current.

After further debate the amendment was defeated and the Address was adopted.

* The "Ipsophone" is a device for recording telephone messages in the absence of the subscriber.

ELECTRICITY SUPPLY

Grimsby Plant Extensions.

Bath.—HIGHER CHARGES LIKELY.—Electricity charges at Bath are likely to increase in the near future, said Alderman W. F. Long, when he was re-elected chairman of the Electricity Committee on November 13th. During the war they had given the city a cheap and efficient supply, but he was not sure they would be able to maintain the supply at anything like the price that had been paid in the past. They had in front of them nationalization, and there would be an undoubted rise in the price of electricity owing to the increased costs of labour and material.

Chesterfield.—EXTENSIONS.—Subject to the approval of the Electricity Commissioners, authority has been given to the electrical engineer to proceed with a £6,787 scheme for extensions in the New Whittington area.

Darlington.—SUBSTATIONS AND METERS.—The Town Council has applied for sanction to borrow £11,620 for substations on the Haughton Road housing site and £7,912 for meters. A substation is to be erected in Merlin Road, Middlesbrough.

Grimsby.—PLANT EXTENSIONS.—Extensions costing £284,700 to be made to the electricity works generating plant have been approved by the Electricity Committee. The extensions include the provision of two boiler units and the necessary ancillary plant, buildings, works and a new cooling tower.

Guildford.—SUPPLY TO GAS COMPANY.—The borough electrical engineer is preparing a scheme for supplying electricity to the Gas Light & Coke Co.'s premises in Onslow Street.

Leicester.—REVISED REVENUE PROPOSALS.—The Electricity Committee has reported to the City Council that the Electricity Commissioners have suggested revised proposals to produce additional annual revenue of £100,000 to £120,000 instead of £168,700, the figure previously suggested. This will result in the increases in electricity charges being less than previously decided upon by the Council.

Salford.—PARLIAMENTARY BILL.—The Corporation has prepared a Bill to secure further powers in connection with its public utility undertakings, including power to charge for special readings of meters, the recovery summarily of sums due for the sale, hire or fixing of apparatus and fittings, the cutting off of supplies where charges, etc., are not wholly paid, and amendment of the provisions relating to the payment of interest by the Corporation on sums deposited with it as security.

Tynemouth.—STREET LIGHTING CONTROL.—Centralized control of street lighting throughout the county borough by means of the d.c. bias system has recently been installed, and was inaugurated at a ceremony which began with a meeting of the Electricity Committee and guests at the electricity works. The chairman of the Electricity Committee (Councillor J. Mayo) mentioned that the system would save the town £1,000 per annum in wages. At the Town Hall the Mayor (Councillor J. Lisle) pressed a button which covered some 600-700 street lamps to be switched on simultaneously all over the town. Councillor T. W. Crawshaw proposed a vote of thanks to the Mayor and to Mr. T. Devonshire, representing Standard Telephones & Cables, Ltd., which supplied and installed the equipment, and Mr. Devonshire replied.

Rising Output in Palestine.

Overseas

Belgium. — POWER COSTS INQUIRY. — The Government has appointed a special commission to inquire into, and report upon, the cost of electric power production, the charges for supply and their effect on the economics of the country.

Palestine.—ELECTRICAL DEVELOPMENT.—The growing use of electricity throughout Palestine is clearly indicated by consumption figures just issued by the Government, in conjunction with the two electricity undertakings—the Palestine Electric Corporation, Ltd., and the Jerusalem Electric & Public Service Corporation, Ltd. The accompanying table gives the total sales

SALES OF ELECTRICITY IN PALESTINE IN MILLION KWH

Period	Total, Both Companies	Palestine Electric Corporation		
		Total	For Irrigation	For Industry
1939	91·5	84·1	28·5	25·1
1942	133·5	123·1	37·4	41·5
1943	161·6	149·5	45·8	49·5
1944	187·8	173·6	50·0	56·4
1945	215·9	199·1	54·0	66·3
Jan.-Aug., 1946	160·2	147·9	38·9	48·7

of both companies and an analysis of the Palestine Corporation's output showing the increased use of electricity for the irrigation of the country and in industry. The figures so far available for the first eight months of 1946 show continued improvement in sales, although the seasonal drop in the use of power for irrigation in the early months of the year was as marked as ever.

Spain.—CO-ORDINATION OF SUPPLY.—The Sociedad Unidad Electrica is the name of a concern organized in Spain some little while ago, with the co-operation of all the principal electric power supply undertakings in the country, to co-ordinate the different supply systems and to arrange for the interconnection of power stations on a uniform plan. It is

also endeavouring on behalf of its constituent undertakings to secure a nation-wide increase in tariffs in order to meet the ever-increasing production costs.

Sweden.—NEW POWER STATION.—The Svenska Cellulosabolaget is to construct a 24,000-kW hydro-electric power station on the Skallboleforsen rapids of the Ljungen River. The station will supply power to all the mills of the combine in the Sundsvall district, and it will take three years to construct at an estimated cost of 10 million kr.—*Reuter.*

Transport

Bradford.—NEW TROLLEY-BUS ROUTE.—The Corporation Transport Committee is to equip Squire Lane for trolley-bus operation at a cost of £1,800.

Gateshead.—TROLLEY-BUSES.—Orders have now been placed by the Gateshead and District Tramways Co., Ltd., for the supply of eighty-three trolley-buses costing £250,000 to replace the trams. The change-over is expected to take place about the end of 1948. The first routes to be dealt with will be Wrekenton and Heworth. The vehicles will be double-deckers each holding fifty-six passengers.

Middlesbrough.—TROLLEY-BUS EXTENSIONS.—The Tees-side Railless Traction Board has received sanction to run a new service from the Bullring, Grangetown, into Grangetown proper and then via the Trunk Road to Normanby Road. Permission is also being sought for a service between Middlesbrough Exchange, Wilton and Dormanstown.

Municipal Reports

Canterbury.—With fewer consumers connected than in the last pre-war year (6,430 against 6,633) the number of kWh sold in the Canterbury area last year—nearly 12 million—was up by over 3 million. The rise in the maximum demand, from 5,690 to 5,975 kW, was not so great in proportion, and the load factor improved from 27·6 to 33·6 per cent. Compared with 1944-45, last year's sales show an increase of 25 per cent. In addition, 4·2 million kWh (against 3·2 million) was supplied in bulk to Herne Bay. The city electrical engineer (Mr. S. J. C. Ellis) reports that the plant at the generating station was maintained at a high degree of efficiency and there was no failure of supply during the year. The accounts record an increase in revenue from £68,159 to £83,273, expenditure on revenue account rising from £60,158 to £77,647. After meeting loan charges, etc., there was a net deficiency of £3,723 against a deficit of £1,350 in the previous year.

Douglas (I.O.M.).—The result of the 1945-46 year's working was a net profit of £9,109 (against £11,908), which has been transferred to the reserve fund. Revenue amounted to £170,788 (£165,221) and working expenses were £126,911 (£114,104). Sales (9·5 million kWh) remained at about the same level as in the previous year; in addition 10·9 million kWh was supplied in bulk to the I.O.M. Electricity Board. The maximum load on the generating stations during the year was 6,612 kW (against 7,711 kW), of which the demand of the Board represented 2,621 kW, the load factor of the undertaking improving from 34·96 to 41·43 per cent. In his report the borough electrical engineer and manager (Mr. B. Kelly) mentions that of the fuel supplied during the year only 16 per cent was of the kind for which the combustion equipment was designed.

Huddersfield.—Besides the normal routine work of the undertaking, two major construction projects were in hand during the past year, i.e., extensions to the St. Andrew's Road generating station and a 33-kV distribution scheme on the first stage of which an expenditure of £146,805 was sanctioned. On the sales side, the borough electrical engineer (Mr. F. A. Ellis) reports a very marked increase in the load due to the growing use of radiators and water heaters by domestic consumers. It is also noted that the introduction of a new farming tariff has encouraged development in supplies for essentially agricultural and horticultural purposes. As regards sales generally, comparison with previous years is affected by a change in the financial year which, in line with most other undertakings, now terminates on March 31st. Industrial and commercial sales rose from 77·0 million kWh in 1939, to 136·3 million in 1942 and then declined to 113·0 million in 1944 and 107·0 million in 1945-46. On the other hand domestic sales, after a setback in 1942 and 1943, rose to 39·4 million kWh in 1944 and 44·5 million in 1945-46. Total consumption last year was 151·5 million kWh at an average price of 0·080d. against 152·5 million at 0·73d. in 1944, 172·8 million at 0·66d. in 1942 and 110·1 million at 0·67d. in 1939. Income amounted to £550,689 and there was a net profit of £10,910. After paying two years' rate contributions (£17,873) and applying £5,726 to capital expenditure the balance carried forward was reduced from £32,121 to £19,432.

Oswestry.—There have been no increases in charges during the war—some tariffs have in fact been reduced—and for the fourth successive year consumers have received a special rebate, the concession this year being 10 per cent on the March quarter's accounts. The borough electrical engineer and general manager (Mr. H. Brackell) says it is hoped that it will soon be possible to review the general schedule of charges to the benefit of consumers. Sales during 1945-46, at 7·3 million kWh, were slightly less than in the previous year as a result of three temporary wartime establishments dropping their loads after the end of the war. The total income was £59,283 and expenditure on revenue account £49,337, there being a net profit (after providing for loan charges, etc.) of £442.

Loch Sloy Contracts

Work for Scottish Concerns

THE North of Scotland Hydro-Electric Board has placed contracts valued at nearly £3,000,000 for work in connection with the Loch Sloy project, which will provide direct employment for over 2,500 men at its peak and involves the construction of a dam at Loch Sloy, the driving of a tunnel through Ben Vorlich, and the erection of a power station with an authorized installed capacity of 130,000 kW on the shores of Loch Lomond. Contracts placed to date have been spread over 50 firms.

Balfour, Beatty & Co., Ltd., have been given the contract for the dam, a massive buttress type concrete wall 1,160 ft long with a maximum height of 165 ft. The construction has been so arranged that before it is finally completed water will be available to drive the turbines in the generating station. Materials will be brought from a quarry at Coiregrogain which is being operated on behalf of the Board by Keir & Cawder, Ltd., Glasgow. A conveyor belt 1½ miles in length capable of handling 1,500 tons of aggregate and sand daily will be used while the dam is being built. J. M. Henderson & Co., Ltd., Aberdeen, will supply two electrically driven aerial cable-ways for the construction of the dam. These will have a span of 1,350 ft with main masts 110 ft high and will be able to carry 8 cu yd of concrete weighing 20 tons at speeds up to 1,000 ft per minute and hoist it 190 ft above the bottom of the dam.

Tunnel through Ben Vorlich

The main tunnel, surge shaft and a subsidiary tunnel, are to be constructed by Edmund Nuttall, Sons & Co. (London), Ltd., builders of the Mersey Tunnel. The main tunnel is to be horse-shoe shaped in section with a finished width of 15 ft 4 in. It will take about two years to cut through 1¾ miles of the mica schist of Ben Vorlich, and the tunnel will then be concrete lined. The surge shaft will consist of a concrete lined vertical shaft 26 ft in diameter, connecting the tunnel to a large surge chamber dug out of the solid rock. The depth from the roof of the surge chamber to the bottom of the shaft will be about 273 ft. The subsidiary tunnel, about a mile long, will be 6 ft wide and 7 ft deep and will divert the waters of the Allt Ardvorlich to the top of the surge shaft.

Sir William Arrol & Co., Ltd., Glasgow, are to supply and erect the steel pipelines which will convey the waters under pressure from the Ben Vorlich tunnel to the water turbines in the power station at Inveruglas. Starting from the tunnel outlet which will be 642 ft above the power station, there will be two lines of electrically welded steel pipes of 10 ft diameter, branching lower down into four lines of about 7 ft diameter. Altogether there will be approximately 7,570 ft of piping. When the dam is full the static head of 910 ft will give a pressure of almost 400 lb per sq in. An electric railway will be used to deliver the pipes to their position on the hillside. The company has also received a contract for a 120-ton crane. The power station foundations are to be excavated and built by Hugh Leggat, Ltd., Glasgow.

Power Station Plant

The English Electric Co., Ltd., Stafford, will supply and erect the four vertical-shaft Francis turbo-alternators and ancillary machinery for the power station, each of which will have an output of 32,000 kW. Raw materials will be obtained from Scotland where practicable and some manufacture will be done there. Each of the four units will weigh about 200 tons, their overall diameter being 30 ft. When the turbines are running at full load 220,000 gallons of water a minute will pass through each of them. The Mirrlees Watson Co., Ltd., Glasgow, is making the main cooling water pumps, piping and valves. Each will be capable of delivering 1,100 gallons of water per minute. The four sets of draft tube bends for the turbines will be made by Mechans, Ltd., Scotstoun, Glasgow. Contracts for the supply and erection of the sluice gates and valves at the outlet of the dam and elsewhere have been placed with Glenfield & Kennedy, Ltd., Kilmarnock. The sluice gates at the dam will weigh 17½ tons and will be 10 ft long and 19 ft deep. They will have to withstand a horizontal load of 1,015 tons and will be operated from electrical control panels in the power house at Inveruglas or at the dam.

Other large orders recently placed by the Board include the supply by Mirrlees, Bickerton & Day, Stockport, of four 450-kW and three 600-kW Diesel driven generating sets, with associated alternators by Bruce Peebles & Co.

Dielectric Losses and Temperature Coefficient

A NEW theory of the dielectric losses and the temperature coefficient of the dielectric constant of amorphous solid substances is put forward by M. GEVERS in a long paper (R.20) published in "Philips Research Reports." The author explains why the ratio between these two quantities in the case of most commercial materials has a value of about 0·06 independently of the nature of the dielectric. From his theory the author has derived a similarity principle of theoretical and practical consequence. The large negative temperature coefficient of rutile ($Ti O_2$) is explained by the large value of its dielectric constant and the paper concludes with remarks about mixed dielectrics.

Forthcoming Events

Monday, December 2nd. — BIRMINGHAM. — James Watt Institute, 6 p.m. I.E.E. South Midland Centre. "The Extinction of Arcs in Air-Blast Circuit Breakers," by A. Allan and D. F. Ames, and "The Influence of Resistance Switching on the Design of High Voltage Oil Circuit Breakers," by H. E. Cox and T. W. Wilcox.

LONDON.—At the Geological Society, Burlington House, W., 5 p.m. The Society of Engineers. "Copper Alloy Resistance Materials," by Dr. H. G. Taylor.

BRADFORD.—Technical College, 7.15 p.m. Bradford Engineering Society. Film entitled "Steam."

LIVERPOOL.—At the Liverpool Royal Institution, Colquitt Street, 6 p.m. I.E.E. Mersey and North Wales Centre. "The Development of the Gas-Cushion Cable System for the Highest Voltages," by T. R. P. Harrison.

Tuesday, December 3rd.—LEEDS.—Leeds Corporation Electricity Department, Whitehall Road, 6 p.m. I.E.E. North Midland Centre. "Power Supply for Generating Station Auxiliary Services," by W. Szwander.

LONDON.—E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2, 7 p.m. Electrical Power Engineers' Association (London Local Group). "Experiences with Power Supply in Western Europe after 'D' Day," by Lt. Col. N. Elliott and Major L. W. Neville.

Oddfellows' Hall, 186, Hammersmith Road, S.W., 7 p.m. Association of Supervising Electrical Engineers (West London Branch). "Some Notes on the Safe Installation of Electrical Equipment," by H. F. Buxton.

GLASGOW. — Ca'doro Restaurant, Union Street, 7.30 p.m. Electrical Society of Glasgow. "More Atomics," by C. N. Smith.

Wednesday, December 4th.—LONDON.—Institution of Electrical Engineers (Radio Section), 5.30 p.m. "The Elements of Wave Propagation Using the Impedance Concept," by H. G. Booker.

I.E.E. London Students' Section, 2 p.m. Visit to the Ford Motor Works, Dagenham.

LEICESTER.—College of Technology, The Newarke, 6.30 p.m. Joint meeting of Institution of Heating and Ventilating Engineers (East Midland Branch) and Institute of Fuel (East Midland Section). "Fuel Analysis and its Practical Application."

LIVERPOOL.—Liverpool Engineering Society, 9, The Temple, 24, Dale Street, 6 p.m. Joint meeting with the I.E.E. Mersey and North Wales Centre. "Some Considerations on the Source of Power Supply," by J. E. Belliss.

Thursday, December 5th.—LONDON.—Institution of Electrical Engineers, 5.30 p.m. "Power Supply for Generating Station Auxiliary Services," by W. Szwander.

Friday, December 6th.—LONDON.—Institution of Electrical Engineers, 5.30 p.m. (Measurements and Transmission Sections). Discussion on "Desirable Features of Protective Relays," opened by C. Ryder and F. H. Birch.

BRISTOL. — Merchant Venturers' Technical College, 7.30 p.m. Junior Institution of Engineers (Western Group). "Engineering Aspects of Atomic Energy," by H. Chatley.

BIRMINGHAM.—Imperial Hotel, Temple Street, 6 p.m. Illuminating Engineering Society (Birmingham Centre). Debate on "Can the I.E.S. Code be Profitably Applied to Industry?"

MANCHESTER. — Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. "Developments in Ship Propulsion," by S. B. Freeman.

Saturday, December 7th.—MANCHESTER.—At the Geographical Society, 16, St. Mary's Parsonage, 2.30 p.m. Junior Institution of Engineers (North-Western Section). "Short Circuit Testing Stations for the Proving of Circuit Breakers," by R. J. Birkinshaw.

LEEDS. — I.E.E. North Midland Students' Section, 2.30 p.m. Visit to the Moorside Edge transmitting station of the B.B.C.

NEWCASTLE-ON-TYNE.—I.E.E. North-Eastern Students' Section, 2.30 p.m. Visit to the works of C. A. Parsons & Co., Ltd.

Monday, December 9th.—BRISTOL.—The University, 5 p.m. I.E.E. Western Centre. Lecture summarizing papers given at the Radiolocation Convention, by Dr. R. A. Smith.

NEWCASTLE-ON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. Paper by T. R. P. Harrison (see above).

BIRMINGHAM.—James Watt Memorial Institute, 7.15 p.m. Institute of Rubber Industry (Midland Section). Forum on "Electrostatic Hazards in Industry." (Several short papers.)

MANCHESTER.—College of Technology, 7.15 p.m. Society of Instrument Technology (North-Western Section). "The Organization of an Industrial Instrument Department," by Messrs. J. O. C. Vick, Lamond and Lindsey.

Tuesday, December 10th.—LONDON.—Institution of Electrical Engineers (Radio Section), 5.30 p.m. Discussion on "The Design and Performance of Receiving Aerials for Television," opened by E. C. Cork.

At E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Railway Lighting: Some Lessons from Experiences and Views on the Future," by A. Cunnington and G. W. Golds.

GLASGOW.—The University. Institute of Physics (Scottish Branch). "Betatrons," by Prof. L. Oliphant.

The Royal Technical College, 6.15 p.m. I.E.E. (Scottish Centre). "Degaussing," by W. C. Potts and I. S. Fraser.

MANCHESTER.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre (Installations Group). "The Analysis of Vibration Problems," by A. J. King.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Electric & Musical Industries, Ltd.—The full accounts for the year to June 30th, confirm that the net profit of the parent company was £165,000, against £150,085 for 1944-45, as intimated in the preliminary statement issued last month. The ordinary dividend is maintained at 6 per cent with a bonus of 2 per cent (same) and £291,340 (£268,902) is carried forward. The consolidated accounts for the group show that the trading profit, with interest and after adjustments and provision for depreciation and obsolescence, was £510,855 lower at £837,830. Tax, however, absorbs only £302,935 (against £706,207) and after providing £259,291 (£337,637) for taxation reserve, £74,088 (£64,790) for pensions, £5,705 (£4,349) for directors' fees, and nil (£50,000) for patent rights the net profit is £195,811 (£185,702).

The chairman (Sir Alexander Aikman) states that as a result of the cancellation of substantial Government war contracts, it has been possible to effect settlement of many items outstanding with the Ministries and the profits from these settlements have been included in the accounts. It is estimated that the amount to be received in respect of the post-war refund of E.P.T., after deduction of income-tax, will be £150,000, but nothing has been included in the accounts.

Crabtree Electrical Industries, Ltd.—The holding company proposes to pay a final dividend of 5 per cent together with a bonus of 7½ per cent, again making a total of 17½ per cent for the year. The full acounts of the operating company, J. A. Crabtree & Co., Ltd., for the year ended July 31st, show a trading profit, with other receipts, of £249,605, compared with £226,986 in 1944-45. After providing for depreciation, expenditure on plant, fees and £119,069 (£142,351) for E.P.T. and income tax, there remains a balance of £107,178 (£77,982). Reserve receives £30,000 (nil), £3,000 (£13,000) is allocated to deferred repairs, and £70,000 (£65,000) in tax-free dividends is paid to the holding company, the forward balance being £81,035 (£76,856).

Adelaide Electric Supply Co., Ltd.—The Adelaide correspondent of *The Times* reports that a Bill has been passed by both Houses of the South Australian Parliament transferring to the Electricity Trust the overseas assets which the Adelaide Electric Supply Co. held, and also giving the Trust control of the Leigh Creek coalmine. The Premier described the legislation as being extremely fair to shareholders. The overseas assets which the directors of the company would not assign to the Trust have been proved by investigation to be substantially larger than believed when the original Bill was introduced, and in consequence deductions from shareholders would be considerably greater than expected. In the case of ordinary shareholders, liquidation rights would more than make up for the deduction. As the Trust would now have the whole undertaking, the Government considered that preference shareholders should be paid the scheduled market value of their shares without deduction, and ordinary shareholders should receive the financial benefits which would accrue to them under the principal Act if it remained in its present form. The Premier emphasized that legal questions regarding the locality of the assets might cause prolonged litigation.

The Isle of Thanet Electric Supply Co., Ltd., has informed the holders of its ordinary and 6 per cent cumulative participating preference stock that the Margate, Broadstairs and District Electricity Special Order, 1946, has now been approved by Parliament. The local authorities concerned are now able to constitute a joint board for the purchase of the undertaking. It is expected that the transfer will be made at the end of the year when a substantial payment will be made on account. The company's debenture stock will be a first charge on the proceeds of the sale and will be repaid at par.

Laurence, Scott & Electromotors, Ltd., were to hold an extraordinary meeting yesterday (Thursday), at which resolutions were to be submitted for increasing the capital of the company to £350,000 by the creation of 100,000 5 per cent cumulative preference shares of £1 each. These shares are to be offered to existing shareholders at par in the ratio of one new preference share for every 20 ordinary held.

The Chloride Electrical Storage Co., Ltd., is again paying an interim dividend of 5 per cent.

The Telephone Manufacturing Co., Ltd., has declared an interim dividend of 2½ per cent (unchanged).

Dictograph Telephones, Ltd., with a final dividend of 7 per cent, is maintaining its distribution for the year at 11 per cent.

New Companies

T. Clarke & Co. (Liverpool), Ltd.—Registered November 19th. Capital, £5,000. To acquire the business now carried on by Richard E. Parkinson at 116/124, Falkner Street, Liverpool, and to carry on the business of electricians, electrical and mechanical engineers, etc. Subscribers: A. J. Russell and J. Kinnear. Regd. office: 116/124, Falkner Street, Liverpool.

Frank Douglas & Co., Ltd.—Registered November 20th. Capital, £1,500. To acquire the business of radio, television and electrical equipment manufacturers, etc., hitherto carried on by F. Vogel and G. F. Stevens at 33, Portland

Road, South Norwood, S.W.25, as "Frank Douglas & Co." Directors: F. Vogel and G. F. Stevens. Secretary: G. F. Stevens. Regd. office: 33, Portland Road, South Norwood, S.E.25.

Electrical & Engineering Corporation (Overseas), Ltd.—Registered November 18th. Capital, £100. Electricians, engineers, etc. Subscribers: Aslam Khan Lodhi and Afzil Hussain. Regd. office: 29, Knightrider Street, E.C.4.

Russell Electrics, Ltd.—Registered November 11th. Capital, £1,000. Manufacturers of, and dealers in, electric, gas and oil lamps, reflectors, bells, etc. Directors: N. Krieger and F. Sedcole. Regd. office: 4, Great Winchester Street, E.C.2.

C. Fenner & Co., Ltd.—Registered November 7th. Capital, £500. Electrical engineers and general electrical installation contractors, etc. Directors: C. Fenner (permanent managing director) and Alexandra Fenner. Regd. office: 6, Brunswick Terrace, Tunbridge Wells.

Middleton Electric Co., Ltd. — Registered November 11th. Capital, £2,000. Electrical engineers and contractors, etc. Directors: A. H. Baker, E. J. Bradbury and C. R. J. Spencer. Regd. office: Yapton Road, Middleton-on-Sea, Sussex.

London Television Co., Ltd. — Registered November 12th. Capital, £1,500. Television and radio and electrical engineers and manufacturers, etc. Directors: C. A. Berwin and V. E. Plant. Regd. office: 159, Stoke Newington High Street, N.16.

W. Bacon, Ltd.—Registered November 12th. Capital, £1,000. Manufacturers of, and dealers in, electrical and wireless apparatus, etc. Subscribers: W. Bacon and J. L. Woods. Secretary: W. J. Barraclough. Regd. office: 75a, Godwin Street, Bradford.

Trevor & R. Lewis, Ltd.—Registered November 12th. Capital, £1,000. Electrical engineers and general electrical installation contractors, wireless engineers, etc. Directors: W. T. H. Lewis and R. L. Lewis. Regd. office: 41, Sterry Road, Gowerton, Glam.

Elpeck Industries, Ltd.—Registered November 12th. Capital, £1,998. General, mechanical, electrical, constructional, motor, marine, radio, telephonic and telegraphic engineers, etc. Subscribers: A. Harris and Elizabeth R. Harris. Secretary: A. Harris. Regd. office: 146, Bishopsgate, E.C.2.

Radiophone (Essex), Ltd.—Registered November 5th. Capital, £50,000. Radio, television and electrical engineers, etc. Directors: E. H. Custon and H. L. Jarvis. Secretary: F. G. Bloxham. Regd. office: Uppark Drive, Ilford.

Trew Electric Services Co., Ltd.—Registered November 19th. Capital, £500. To acquire the business of Trew Electric Services Co. now carried on by S. A. T. Haines at 526, Durham Road, Gateshead, and to carry on the business of radio and electrical engineers, etc. Permanent directors: S. A. T. Haines and R. G. E. H. Downer. Secretary: Capt. P. Bell. Regd. office: Saville House, 1, Saville Row, Newcastle-on-Tyne.

Increases of Capital

Bristol Rediffusion Service, Ltd.—Increased by £50,000, beyond the registered capital of £25,000.

Buckrose Light & Power Co., Ltd.—Increased by £20,000 beyond the registered capital of £200,000.

Wigtownshire Electricity Co., Ltd.—Increased by £10,000 beyond the registered capital of £175,000.

Milnes Electrical Engineering Co. (Bingley), Ltd.—Increased by £28,000 beyond the registered capital of £2,000.

Kingston Lamp Co., Ltd.—Increased by £4,000, in £1 shares, beyond the registered capital of £1,000.

Liquidations

Green Electrical Industries, Ltd., 80, Wimpole Street, Cavendish Square, London, W.1.—Under a compulsory winding-up order made recently meetings of the creditors and shareholders were held at the Board of Trade Offices, Columbia House, Aldwych, London, W.C.2, when the Official Receiver reported that no statement of affairs had yet been filed. The unsecured liabilities were estimated at £4,300, and assets were stated to be plant and stock to the value of approximately £1,500; book debts £500; and the unexpired portion of the lease of the company's premises. Resolutions were passed for the appointment of Mr. A. E. Attwood, of 90, Queen Street, London, E.C.4, as liquidator of the company. A committee of inspection was also appointed.

Waterloo Electric Supplies, Ltd.—Meeting December 27th at 48, Mosley Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. W. Pickles.

Bankruptcies

C. W. Sands, electrical and wireless contractor, High Street, Kings Langley, Herts.—Order made October 22nd, 1946, suspending discharge for one month. Discharged as from November 22nd, 1946.

R. H. Levy, electrician, 29, Roman Road, Linthorpe, Middlesbrough.—Trustee, Mr. C. G. Sparrow, 14, Bridge Road, Stockton-on-Tees, released October 22nd, 1946.

A. S. Britton, radio engineer and electrical contractor, carrying on business at 9, Moorside Road, Heaton Moor, Stockport, and at 123, Higher Hillgate, Stockport.—Receiving order made November 18th, 1946, on a creditor's petition.

STOCKS AND SHARES

STOCK Exchange markets are more active to-day than they have been for many years past. The reason for the latest outbreak of animation is publication of the Government's terms for taking over the railways. The result, shortly put, has been to develop a rush of purchasing of stocks and shares that will give a better return on the money than will be available from the compensation terms laid down by the Government in taking over the Home Railway stocks. In exchange, a Government security is to be given which will considerably reduce income. On the other hand, it should have the effect of increasing capital values.

Arbitrary Compensation Basis

Quotations in the market for Home Railway and L.P.T.B. stocks have settled down at a level several points below prices announced by the Minister of Transport as the basis for compensation on nationalization. As stockholders now know, they are to receive as compensation an amount of Government stock equal to the value of their holdings at the average prices ruling during the first week in November. Selection of that basis for the purpose appears to have been purely arbitrary, and for this reason, apart from the question of principle, it has invoked sharp criticism, which points to the many anomalies which arise from it. No mention has as yet been made of the nature of the compensation stock, or of what interest it it will bear, although a 2½ per cent stock is most generally expected. Unlike the compensation stock proposed for the coal industry, however, there will be no restrictions on its negotiability.

The Holder's Choice

Holders of these railway stocks are now having to make up their minds whether to accept in due course the Government compensation stock and the inevitable loss of income, or whether to sell for reinvestment in higher-yielding stocks of lower security. Many holders have acted already on the second alternative. In part, this accounts, on the one hand, for the recent appreciation of investment stocks generally, and, on the other hand, for the quotation of railway stocks at prices well below the fixed compensation table. That sellers are prepared to part from their stock at a fairly substantial discount is shown, for example, in the quotation of Southern Railway 5 per cent preference at 118½, against the Government price of 124 7/16, and of L.P.T.B. 4½ per cent "A" stock at 127½, against 133 5/16.

Income Considerations

In terms of income, an exchange from railway stocks into a 2½ per cent compensation stock on the proposed terms would result in an appreciable reduction, although the security would, of course, be of a higher order. In the case, for example, of Southern 5 per cent preference mentioned above, present income of £50 from £1,000 stock would compare with £30 12s. 6d. from £1,245 compensation stock issued at par and bearing interest at 2½ per cent. To maintain the original income, it would be necessary to reinvest on a yield basis of 4 per cent. So long as the actual form of the compensation stock remains undisclosed, calculations of this sort lack a firm basis. Nevertheless, they are largely responsible for the recent selling of the stocks concerned, and the intensified hunt for securities which will provide capital with a living wage and reasonable safety.

Electricity Supply

Naturally enough the market in electricity supply shares follows with acute interest the treatment accorded to industries which are earlier in the nationalization list. The market has been upset to some extent by the Government's change of policy in dealing with the railways. In the case of the coal mines and of Cable & Wireless, the compensation problem has been left largely to independent tribunals that concern themselves, amongst other things, with the calculation of asset values and maintainable revenue. Procedure on these lines has engendered a good deal of confidence in the position of the electricity industry, and has done much to support the recent all-round appreciation of the shares concerned. In departing from this policy, and substituting one based on a purely arbitrary valuation, the Government has introduced a further element of uncertainty which has proved disconcerting to hundreds of investors.

A Month of Rises

Since a month ago, many prices of electrical equipment shares have advanced to an extent which borders on the spectacular. Rises of 7s. 3d. in General Electrics, now 103s., and of 6s. in Associated Electrical Industries, at 72s., are no more than representative of the appreciation which has lately taken place in industrials of the best investment character. Advances of half-a-crown on the month are commonplace. This amount has been gained by, amongst others, English Electrics at 63s., Crompton Parkinsons, 34s., and Plesseys, 36s. 3d. Chloride Electricals are up 7s. 6d. at 5½. In the cable manufacturing group, Johnson & Phillips at 81s. 6d. have put on 3s. 6d., while Enfields, 52s. 6d., Henleys, 28s., and B.I.C., 46s. are all better. Lancashire Dynamos at 6 have added 10s., and De La Rues at 13½ are as much as £1 higher. Some of the biggest rises took place in the engineering group, where gains of anything from 6s. to 9s. have occurred in Babcock & Wilcox at 69s., International Combustion, 9½, Tube Investments, 6 5/16, Hopkinsons, 5 5/16 and Westminghouse Brakes, 78s. 9d. Arons at 51s. 3d., Reyrolles at 77s. 6d. and Automatic Telephones

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ELECTRICAL INVESTMENTS

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price Nov. 22	Month's Rise or Fall	Yield p.c.
Home Electricity Ordinary					£ s. d.
Bournemouth and Poole	12½	12½	66/–	+1/6	3 15 8
British Power and Light	7	8	33/6	..	4 15 7
City of London	6	7	34/–	+½	4 2 4
Clyde Valley	8	8	42/6	–3d.	3 15 3
County of London	8	10	45/6	–6d.	4 8 0
Edmundsons	6	6	28/–	–1/–	4 5 9
Elec.Dis.Yorkshire	9	9	49/6	+3/6	3 13 0
Elec. Fin. and Securities	13½	15	66/6	+3/6	4 10 3
Elec. Supply Corporation	10	10	47/9	+3/3	4 3 4
Lancs. Light and Power	7½	7½	34/6	+2/–	4 7 0
Llanelly Elec.	6	6	28/–	+6d.	4 5 9
Lond.Assoc.Electric	4	6	28/–	+1/–	4 5 9
London Electric	6	6	28/–	+2/–	4 5 9
Metropolitan E.S.	8	9	44/6	+2/–	4 1 0
Midland Counties	8	8	48/6	+4/–	3 6 0
Mid. Elec. Power	9	9	47/6	+2/–	3 16 0
Newcastle Elec.	7	7	34/–	+3/–	4 2 4
NorthEasternElec.	7	7	35/–	+3/–	4 0 0
Northampton	10	10	51/–	+3/–	3 18 6
Northmet Power.	7	9	43/6	..	4 2 10
Scottish Power	8	9	43/6	+3/6	4 2 9
Southern Areas	5	5½	23/6	+1/3	4 13 7
South London	7	7	33/–	+2/–	4 4 10
Yorkshire Elec.	9	9	47/6	+6d.	3 16 0
Public Boards					
Central Electricity:					
1963–93	3½	3½	113	+1½	3 2 0
1974–94	3½	3½	113	+4	2 17 6
LondonElec.Trans.	2½	2½	102	+2	2 9 0
Lond.Pass.Trans.Bd.					
A	4½	4½	127⅞	+1	3 11 0
B	5	5	123	+½	4 1 4
C	3	3	64½	+6	4 13 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	8/9	+6d.	—
Calcutta Elec.	6*	6*	55/–	..	2 3 8
Cawnpore Elec.	13	13	58/6	..	4 8 10
EastAfricanPower	7	7	46/–	+1/–	3 1 0
Jerusalem Elec.	5	5	24/–	+1/–	4 3 4
Madras Elec.	4	6	36/6	–1/6	3 5 9
Montreal Power.	1½	1½	24½	+1	—
Nigerian Elec.	10	12½	42/–	..	5 19 0
PalestineElec."A"	5*	6*	36/6	+1/–	3 5 6
Perak Hydro-elec.	6	7	15/–	+6d.	—
Tokyo Elec. 6%	6	6	39½	–4	—
VictoriaFallsPower	15	19	5⅝	+⅛	3 7 7
Whitehall Inv.Pref.	—	6	27/6	+1/–	4 7 3
Equipment and Manufacturing					
Aron Elec. Ord.	15	10	51/3	–3/3	3 18 2
Assoc. Brit. Eng.	8	12	42/6	+½	5 13 0
Assoc. Elec.:					
Ord.	10	10	72/–	+6/–	2 15 6
Pref.	8	8	47/6	+5/–	3 7 6
AutomaticTel.&El.	12½	12½	74/3	+2/9	3 7 2
Babcock & Wilcox	12	12½	69/–	+7/9	3 12 8
Equipment and Manufacturing (*Continued*)					£ s. d.
Baldwin,H.J.(2/–)	10	20	12/6	–6d.	3 4 0
British Aluminium	10	8	45/3	+5/3	3 10 10
British Insulated & Callender's			46/6	+2/–	—
British Rola (2/–)	15	15	7/–	–1/–	4 5 9
BritishThermostat (5/–)	18½	18½	22/6	..	4 2 3
BritishVac.Cleaner (5/–)	30	20	25/–	..	4 0 0
Brush Ord.(5/–)	10	4	7/9	..	2 11 7
Burco (5/–)	15	20	30/–	+2/6	3 6 8
ChlorideEl.Storage	15	15	5½	+⅜	2 18 6
Christy Bros.	12½	17½	85/–	+½	4 2 4
Cole, E. K. (5/–)	20	20	29/–	–2/3	3 9 0
Cossor, A. C. (5/–)	10*	12½*	31/–		2 0 4
Crabtree (10/–)	17½	17½	47/6	+1/3	3 13 8
CromptonParkinson Ord. (5/–)	22½	22½	34/–	+2/6	3 6 2
De La Rue	40	45	13½	+1	3 6 8
Decca (1/–)	100	112	52/6	–1¼	2 2 8
E.M.I. (10/–)	8	8	28/6	–3d.	2 16 2
Elec. Construction	10	12½	63/6	..	3 18 7
Enfield Cable Ord.	12½	12½	52/6	–1/–	—
English Electric	10	10	63/–	+½	3 3 6
Ericsson Tel. (5/–)	22*	20*	53/9	+1/3	1 17 6
Ever Ready (5/–)	40	40	47/–	+2/–	4 5 0
Falk Stadelmann	7½	10	43/9	+1¼	4 11 4
Ferranti Pref.	7	7	36/3	+2/3	3 17 3
G.E.C. Pref.	6½	6½	40/6	+3/6	3 4 3
Ord.	17½	17½	103/–	+7/3	3 7 10
GeneralCable(5/–)	15	15	24/–	+1/–	3 2 6
Greenwood&Batley	15	15	51/–	–1/–	5 17 8
H.T.A. (10/–)	12½	10	21/3	–3d.	4 14 0
Heatrae (3/–)	12½	12½	7/9	+3d.	4 18 0
Henley's (5/–)	20	20	28/–	+1/6	3 11 5
4½% Pref.	4½	4½	28/6	+3/6	3 3 2
Hopkinsons	17½	20	5⅛	–⅛	3 17 3
Intl. Combustion	30	32½	9⅛	+⅞	3 11 2
Johnson & Phillips	15	15	81/6	+3/6	3 13 6
LancashireDynamo	22½	22½	6	+⅛	3 15 0
Laurence,Scott(5/–)	12½	12½	15/3	+1/9	4 2 0
London Elec. Wire	7½	7½	42/–	+1/3	3 11 5
Mather & Platt	10	10	55/9	+3/3	3 12 0
Metal Industries(B)	9	10	61/9	+5/6	3 4 9
Mid. Elec. Mfg.	25	25	9	+⅛	2 15 6
Murex	20	20	93/9	+1¼	4 5 6
Newman Ind.(2/–)	22½	22½	9/3	+3d.	5 0 0
Plessey (5/–)	20	20	36/3	+½	—
Power Securities.	6	6	32/–	+6d.	3 15 0
Pye Deferred (5/–)	25	25	32/6	+⅛	3 17 0
Radio & Tel. (2/–)	25	10	11/6	+2/–	—
Revo (10/–)	17½	20	52/6	+1/6	3 16 0
Reyrolle	12½	12½	77/6	+3/6	3 4 6
Scophony (5/–)	—	—	9/–	+2/–	—
Siemens Ord.	7½	7½	37/–	+6d.	4 1 2
Strand Elec. (5/–)	10	12½	11/9	..	5 6 8
Switchgear&Cowans (5/–)	20	20	25/–	–1/–	4 0 0
T.C.C. (10/–)	10	12½	33/–	+⅛	3 15 8

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Nov. 22	Month's Rise or Fall	Yield p.c. £	s.	d.
Equipment and Manufacturing (*Continued*)							
T.C. & M. ..	10	10	53/9	−9d.	3	14	6
TelephoneMfg.(5/–)	9	9	13/6	+6d.	3	6	8
Thorn Elec. (5/–)	20	20	30/–	−½	3	6	8
Tube Investments	20	22½	6⅝	+⅛	5	8	2
Vactric (5/–) ..	Nil	Nil	17/6	+⅛		—	
Veritys (5/–) ..	7½	7½	8/–	+3d.	4	13	10
WalsallConduits(4/–)	55	55	56/–	+1/–	3	18	2
Ward & Goldstone (5/–)	25	35	52/–	+5/–	3	7	4
Watford (2/–) ..	15	15	7/3	..	4	2	9
WestinghouseBrake	14	14	78/9	+⅝	3	11	1
West, Allen (5/–)	7½	7½	9/6	+1/6	3	19	0
Traction and Transport							
Brit.Elec.Traction:							
Def. Ord. ..	45	45	1220	+110	3	15	0
Pref. Ord. ..	8	8	192	+9	4	3	5
Calcutta Trams..	6½	7½	57/6	−¼	2	12	0
Cape Elec. Trams	5	6	37/6	+5/6	3	4	0
Southern Rly.:							
5% Prefd. ..	5	5	74½	−½	6	14	3
5% Pref. ..	5	5	118½	+5	4	4	5
Traction and Transport (*Continued*)							
T. Tilling ..	10	10	58/–	+½	3	9	0
West Riding ..	10	15	53/6	+3/6	5	12	0
Telegraph and Telephone							
Anglo-Am. Tel.:							
Pref. ..	6	6	143½	+5	4	3	6
Def.	1½	1½	35½	+2½	4	4	6
Anglo-Portuguese	8	8	29/–	−1/–	5	10	4
Cable & Wireless:							
5½ Pref. ..	5½	5½	125	+8½	4	8	0
Ord.	4	4	117	+5	3	8	5
CanadianMarconi$1	Nil	4 cts.	15/–	−9d.		—	
Globe Tel. & Tel.:							
Ord.	8¼*	5*	45/–	+2/–	2	4	5
Pref.	6	6	36/–	+3/–	3	6	8
GreatNorthernTel. (£10)	20	18	34½	+2	5	4	4
Inter. Tel. & Tel.	Nil	Nil	18	−3		—	
Marconi-Marine..	7½	7½	33/6	..	4	9	7
Oriental Tel. Ord.	4	4	55/6	..		—	
Telephone Props.	Nil	6	21/6	−1/–	5	11	7
Tele. Rentals(5/–)	10	10	15/–	−1/–	3	6	8

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from p.* 901)

at 74s. 3d. are other strong features. Ward & Goldstone at 52s. are 5s. better on the month.

Cable & Wireless stocks have shared in the month's general advance of prices. The ordinary put on 5 points to 117, and the preference 8½ to 125. Globe Telegraph stocks are sympathetically better, the ordinary showing a rise of 2s. at 45s. and the preference of 3s. to 33s. 6d. Anglo-American Telegraph preferred added 5 points to 143½. Elsewhere, Vactrics at 17s. 6d. have recovered 3s. 9d. from previous losses, and British Aluminiums are 5s. 3d. higher at 45s. 3d. Among other electrical descriptions Crabtrees 47s. 6d., London Electric Wire 41s. 3d., and Walsall Conduits 56s., have participated in the upward tendency.

A Breach of Faith ?

Southern Railway 5 per cent Preference had been up to 123½, ten points higher since a month previously, before the price reacted to 118½ following publication of the Government's compensation plan. The 5 per cent preferred rose to 78, but came back to 74½. London Passenger Transport " C " at 67 was showing a gain of 8½ in three weeks; fairly heavy selling reduced it to 64½. Amongst the Board's stock issues is one for nearly £13 millions in 3 per cents guaranteed by the Treasury and dated 1967-72. If the Government intends to include this in its compensation scheme, the stockholders can justifiably charge the Government with a grave breach of contract. So evident is this that the Stock Exchange was urged to remove the quotation from the daily Official List, and the matter was raised in Parliament.

British Electric Traction deferred is 110 up at 1,220, a reaction of 30 from the recent best. Thomas Tillings are 5s. higher, since a month ago, at 58s.

Radio Results

Radio & Television Trust exceeded best expectations with a declaration of a 25 per cent dividend, plus 15 per cent cash bonus. The latter makes up for the cut in last year's distribution from 25 to 10 per cent. Preliminary figures indicated that the trading profits of the company —formerly known as Philco—have been more than doubled, to £237,000. This expansion not only covers the bigger distribution, but provides also for the necessary strengthening of the balance-sheet position. In anticipation of the dividend, the price of the 2s. shares rose from 10s. 3d. to 11s. 6d. On the 25 per cent dividend, excluding the bonus, the yield works out at 4½ per cent. Decca shares have practically recovered from the previous disappointment over the mere maintenance of the recent dividend. The shares are a steady market at 52s. 6d. ex dividend.

Shares on Offer

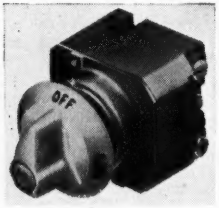
In the dwindling list of electrical equipment preference shares available in the market are English Electric 3½ per cents at 24s. 9d.: the yield is £3 0s. 6d. per cent. Amongst ordinary shares there are small lines available in Walsall Conduits at 56s. and Allen Wests at 10s., the yields being 3⅞ and 3¾ per cent respectively. Crabtree Electrical Industries are offered at 47s. 9d., ex the final dividend, to yield £3 13s. 3d. per cent, and Westinghouse Brakes at 80s. to give 3½ per cent. The return on Lancashire Dynamos, at 6, is 3¾ per cent, and Newman Industries at 9s. 1½d. offer the relatively high yield of £4 18s. 6d. per cent.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Rotary Cooker Switch

THE first of a range of temperature regulating devices to be manufactured by TURNRIGHT CONTROLS, LTD., Colesgrove Farm, Goff's Oak, Herts, which was formed in February last, is a rotary switch for cooker ovens, boiling-plates and grills. It is of the single-pole, three-heat design for series-parallel connection with a rating of 10 A at 250 V for flush mounting and is available with either a porcelain pointer or plastic moulded self-indicating handle.

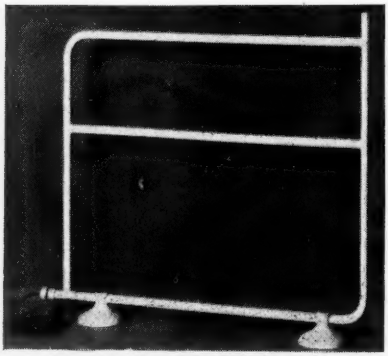


Grill-cooker switch with skirted self-indicating knob

Both are of the spring loaded screw-on pattern and either can be fitted to the one type of switch, which has a standard single swage spindle, so avoiding any necessity to stock two varieties. The handle fits up to the cooker panel neatly without needing a grub-screw. The switch is interchangeable with existing makes.

Tubular Towel Rail

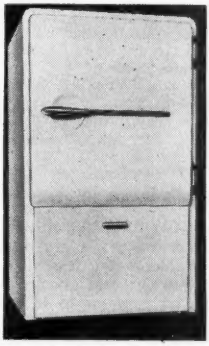
The " Mindus " electrically-heated towel rail of modern tubular design is now available from MIDLAND INDUSTRIES, LTD., Heath Town Works, Wolverhampton, in three colours, white, cream and green. A 225-W immersion type element of the company's own manufacture is used in each model, the rail being filled with water. Normally the apparatus operates at 150-160 deg F depending on the surrounding temperature; it will reach this temperature in 40-60 minutes. Screws through holes in the feet fix the towel rail permanently in position.



" Mindus " towel rail

Small Domestic Refrigerator

A household refrigerator of, it is claimed, entirely new design has been put into production by ELECTROLUX, LTD., Luton, Beds. It has a high-gloss enamel finish with plated chromium and black ornamentation. Automatic " cold control " is provided. The interior of the cabinet is porcelain enamelled, its storage capacity being 1·6 cu ft, with two removable shelves and one ice-making tray. Refrigeration is on the continuous absorption principle, without machinery, moving parts, noise, vibration, or radio interference, all of which should minimize cost of maintenance. This model L.150 is " free standing," of the same general design as the well known M.151 built-in model. It is 2 ft 11½ in. high, 1 ft 8⅝ in. wide and 1 ft 9⅜ in. deep.



Continuous absorption refrigerator

Special Fluorescent Lamps

More than thirty different types of fittings for fluorescent lighting tubes are now listed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. One model is designed for surgical operating theatres in hospitals, providing an intensity of the order of 350 lumens per sq ft when mounted about 3 ft above the table.

It is constructed of aluminium and is 6 ft long by 4·5 ft broad and 10 in. deep, accommodating five 80-W tubes, each within its own anodized reflector. In addition, four parabolic reflectors, each containing a 100-W lamp bulb behind a glass screen, are intended to be energized from a separate source to provide 170 lumens per sq ft in emergency.

The fitting is cross-suspended from the ceiling so that it can be tilted in any direction; hinged doors at each end provide access to the tube starter switches and the stand-by bulbs, while the chokes and capacitors can be installed remotely from the fitting, which is connected by a chromium plated flexible hose to the outlet.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

R. W. BAILEY, H. H. Burton, A. B. Winder, Metropolitan-Vickers Electrical Co., Ltd., and English Steel Corporation, Ltd.—" Casting metals." 7407. April 24th, 1940. (582163.)

E. Barraclough and P. A. H. Mossay.—" A.C. motor control systems." 4649. March 13th, 1944. (582250.)

British Thomson - Houston Co., Ltd.—" Methods of treating carbon electrodes." 15311/44. August 13th, 1943. (582107.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—" High frequency oscillators." 10197. May 25th, 1944. (582222.)

British Thomson-Houston Co., Ltd., and J. E Stanworth.—" Glass." 8207. May 24th, 1943. (582180.)

British Thomson-Houston Co., Ltd., C. J. Milner and W. J. Scott.—" Velocity modulated electron discharge tubes." 11445. August 14th, 1942. (582240.)

British Thomson-Houston Co., Ltd., W. J. Scott and C. S. Wright.—" Electron discharge devices employing cavity resonators." 1335. January 26th, 1943. (582241.)

L. F. Broadway and N. C. Barford.—" Circuit arrangements employing velocity modulation electron discharge devices." 9030/44. May 11th, 1944. (582217.)

L. F. Broadway, N. C. Barford and A. F. Pearce.—" Production of annular beams of electrons." 10353. June 25th, 1943. (582183.)

Carlisle Electrical Manufacturing Co., Ltd., S. H. Collings and W. Taylor.—" Rotary electric switches." 5217. March 21st, 1944. (582193.) " Rotary electrical switches, contact members therefor." 4549. March 11th, 1944. (582194.)

Carnegie-Illinois Steel Corporation.—" Conductor rolls of continuous strip electroplating apparatus." 8261/44. August 28th, 1943. (582153.)

Chloride Electrical Storage Co., Ltd. (C. Ambruster).—" Electric accumulators." 15151. August 9th, 1944. (582105.)

J. D. Cockcroft and P. E. Pollard.—" Radio equipment for locating distant bodies." 3925. March 24th, 1942. (582169.) " Operation and control of cathode ray indicators." 3927. March 24th, 1942. (582170.)

E. C. Cork and M. Bowman-Manifold.—" Electromagnetic wave guides." 11443. August 14th, 1942. (582088.)

A. C. Cossor, Ltd., and M. W. Brooker.—" Control arrangements for electric welders." 11147. June 10th, 1944. (582225.)

F. B. Dehn (Press Wireless Inc.).—" Facsimile transmitting and reproducing systems." 14540. September 6th, 1943. (582243.)

J. M. Dodds and Metropolitan-Vickers Electrical Co., Ltd.—" Tunable radio receivers." 10140. September 8th, 1941. (582128.)

J. M. Dodds, C. W. Miller and Metropolitan-Vickers Electrical Co., Ltd.—" Cathode-ray tubes." 10136. September 8th, 1941. (582201.)

J. M. Dodds, G. J. Scoles and Metropolitan-Vickers-Electrical Co., Ltd. " Control circuits for cathode-ray apparatus." 10137. September 8th, 1941. (582125.)

J. M. Dodds, H. Whalley and Metropolitan-Vickers Electrical Co., Ltd.—" Radio receivers." 10143. September 8th, 1941. (582202.)

Dorman & Smith, Ltd., and J. Lund.—" Construction of sockets for electric plug and socket connections." 16098. August 23rd, 1944. (582272.)

J. M. Fleming.—" Measurement of power losses in electrical insulating materials." 5505. March 24th, 1944. (582251.)

General Electric Co., Ltd., and E. Friedlander.—" Excitation of alternators." 3345. March 13th, 1942. (582086.)

General Electric Co., Ltd., and H. R. L. Lamont.—" Duplex radio-signalling systems." 5071. March 29th, 1943. (582176.)

General Electric Co., Ltd., H. G. Jenkins, A. H. M. McKeag and P. W. Ranby.—" Luminescent materials." 4764. April 10th, 1941. (582122.)

General Motors Corporation.—" Refrigeration apparatus." 11485/44. June 30th, 1943. (582227.)

H. L. Guy, R. B. Noad and Metropolitan-Vickers Electrical Co., Ltd.—" Pipe connections to enclosed members." 5951. May 7th, 1941. (582082.)

H. Hughes & Son, Ltd., A. L. Serham and A. J. Hughes.—" Stabilized radar scanner equipment mounted on vehicles of all kinds." 11569. June 17th, 1944. (582257.)

V. S. Johnson.—" Device for making precise mechanical adjustments, such as tuning radio apparatus." 6257/43. April 18th, 1942. (582136.)

D. I. Lawson, D. Weighton and Pye, Ltd.—" Electrical apparatus for determining distances or short intervals of time." 3289. February 21st, 1940. (582161.)

Linde Air Products Co.—" Automatic electric welding apparatus." 12905/44. July 31st, 1943. (582234.)

Maschinenfabrik Oerlikon.—" Electrical relays." 13058/44. September 9th, 1943. (582261.)

Micafil, Ltd.—" Ironing insulating materials on to the straight bar portions of electric coils."

6922/44. December 10th, 1942. (582211.)

M-O Valve Co., Ltd., and G. W. Warren.—" Thermionic valves adapted to operate at very high frequencies." 4724. March 13th, 1940. (582162.)

M-O Valve Co., Ltd., E. G. James, and G. W. Warren.—" Thermionic valves." 11806. July 17th, 1940. (582164.)

R. B. Noad and Metropolitan-Vickers Electrical Co., Ltd.—" Lock-nut devices and the like." 5956. May 7th, 1941. (582123.)

A. F. Pearce and N. C. Barford.—" Electron discharge devices employing hollow resonators." 11257. August 11th, 1942. (582173.)

W. S. Percival.—" Electric waveguides." 7601. May 12th, 1943. (582179.)

H. B. Prentice.—" Quick make and break electrical switches." 14837. August 3rd, 1944. (582267.)

D. R. Price and Metropolitan-Vickers Electrical Co., Ltd.—" Electric metering instruments and systems employing same." Cognate applications 1154/44 and 4202/45. January 20th, 1944. (582246.)

S. Rey.—" Sound recording devices." 7466. May 11th, 1943. (582178.)

G. J. Scoles and Metropolitan-Vickers Electrical Co., Ltd.—" Radio receivers." 10138. September 8th, 1941. (582126.) " Thermionic valve circuits." 10141. September 8th, 1941. (582129.)

G. J. Scoles, C. W. Miller and Metropolitan-Vickers Electrical Co., Ltd. — " Electric frequency changing circuits." 10142. September 8th, 1941. (582130.)

G. J. Scoles, H. Whalley and Metropolitan-Vickers Electrical Co., Ltd.—" Radio receivers." 14424. November 8th, 1941. (582131.)

Smart & Brown (Engineers), Ltd., and W. H. Spivey.—" Means for gripping and holding electric conductors and cables." 15353. August 11th, 1944. (582108.)

Soc. Anon. des Industries Radio-Electriques S.A.D.I.R.—" Arrangements for feeding oscillatory current to aerials or other loads." 3537/42. May 26th, 1941. (582133.)

Soc. Française Radio-Electrique.—" Electric discharge valves." 12050/42. April 1st, 1941. (582135.)

Sperry Gyroscope Co., Inc.—" Radio noise-reducing systems operating to eliminate noise that is displaced in time with respect to received pulse signals." 14364/42. March 12th, 1942. (582279.)

Standard Telephones & Cables, Ltd.—" Carrier wave demodulation systems." 14701/44. April 30th, 1943. (582100.) " Electrical oscillation generator." 2135/44. November 30th, 1942. (582146.) " Selenium elements." 7988/44. May 1st, 1943. (582214.) " Repeaters for electric carrier wave signal pulses." 12532/44. July 1st, 1943. (582231.) " Electric cables." 15572/44. November 15th, 1943. (582270.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—" Arrangements for determining distance by reflection of electromagnetic waves." 18846. November 12th, 1943. (582187.)

Standard Telephones & Cables, Ltd., and A. C. Delamare.—" Stencils." 11726. May 10th, 1945. (582274.)

Standard Telephones & Cables, Ltd., and W. T. Gibson.—" Means for adjusting high-frequency electric discharge devices." 15334. October 16th, 1940. (582165.)

Standard Telephones & Cables, Ltd., and F. D. Goodchild.—" Ultra high-frequency electron discharge tubes." 2024. February 14th, 1941. (582166.)

Standard Telephones & Cables, Ltd., and B. B. Jacobsen.—" Arrangements for determining distance and bearing by electromagnetic waves." 14707. November 14th, 1941. (582085.)

Standard Telephones & Cables, Ltd., and R. G. Roach.—" Oscillation generators of the velocity modulation type." 6279. May 8th, 1942. (582171.)

Standard Telephones & Cables, Ltd., and H. P. Williams.—" Glide path systems for aircraft." 3298. March 11th, 1941. (582081.) " Radio navigational systems." 12238. June 27th, 1944. (582230.)

Standard Telephones & Cables, Ltd., W. A. Beatty and L. W. Houghton.—" Systems for the electric transmission of sound and other waves." 952. January 16th, 1940. (582080.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and L. W. Houghton.—" Radio locating arrangements." 10008. July 17th, 1942. (582172.) " Multiplex high-frequency electrical pulse signalling systems." 5587. April 7th, 1943. (582177.) " Multiplex high-frequency electrical pulse signalling systems." 18640/44. April 7th, 1943. (Divided out of 582177.) (582198.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and L. W. Houghton.—" Multiplex high - frequency electrical pulse signalling systems." 18641/44. April 7th, 1943. (Divided out of 582177.) (582199.)

V. R. Symons, G. M. Symons and G. Trenter.—" Portable welding units or plants." 15228. August 10th, 1944. (582106.)

Western Electric Co., Inc. — " Radar apparatus." 11838/44. June 22nd, 1943. (582228.) " Electromechanical delay devices." 12546/44. July 8th, 1943. (582232.)

Westinghouse Electric International Co.—" Power plants." 6872/44. January 20th, 1943. (582151.) " Turbine apparatus." 6874/44. January 20th, 1943. (582152.)

H. Whalley, C. W. Miller and Metropolitan-Vickers Electrical Co., Ltd.—" Radio receivers." 10139. September 8th, 1941. (582127.)

H. Whalley, G. J. Scoles and Metropolitan-Vickers Electrical Co., Ltd.—" Radio receivers." 10134. September 8th, 1941. (582124.)

Woods of Colchester, Ltd., and B. B. Daly.—" Ventilating apparatus." 20831. December 13th, 1943. (582140.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—The following contracts are announced in *Tenders* (Melbourne):—NEW SOUTH WALES.—December 23rd. Public Works Department. Steam raising plant and 12,500-kW turbo-alternator and auxiliary equipment for Port Kembla power station, extension "E." —N.S.W. Government Offices, London.

VICTORIA.—January 15th. Victorian Railways. 1,500-kW automatically controlled rectifier units.

February 11th. (Extended date.) State Electricity Commission. Six water-tube boilers complete with auxiliary and accessory plant for Yallourn (Spec. 46-47/1). Agent-General for Victoria, London.

Bury.—December 9th. One 1,250-kVA and two 625-kVA 6,500/400/230-V three-phase transformers. (November 22nd.)

Cleethorpes.—December 20th. Electricity Department. Four 500-kVA transformers. (November 22nd.)

Darlington.—Town Council. Electricians' work for 102 houses, Tennyson Gardens. Particulars from the borough engineer.

Heston and Isleworth. — December 15th. Borough Council. One 10,000-kVA transformer. (November 22nd.)

Kingston-upon-Thames.—December 9th. Corporation. Paper-insulated cables. (November 15th.)

Manchester. — December 6th. Electricity Department. Air-cooling pipework for Nos. 67 and 68 boilers. (November 15th.)

December 13th. Soot-blowers for Nos. 65 and 66 boilers. (November 15th.)

New Zealand.—January 21st. Hydro-Electric Department. 11-kV control and relay boards for Oamaru and Ashburton substations.

North Scotland. — Hydro - Electric Board. Supply and erection of 132-kV transmisson lines. (November 22nd.)

South Westmorland.—December 14th. Rural District Council. Centrifugal pumps and motors, with switchgear in duplicate. Engineer's Department, Council Offices, 30, Lowther Street, Kendal.

Stone (Staffs.).—December 14th. Rural District Council. Conversion of Longton Road pumping station from steam to electricity.—Engineer, Town Hall, Stone, Staffs.

Warwick.—December 2nd. County Council. Contracts for heating and electrical engineers. (November 15th.)

Orders Placed

Alloa.—Town Council. Electrical installation at Hawkhill housing scheme (£5,872).—J. Scott & Co.

Newcastle-on-Tyne.—City Council. Accepted. Installation of electric lighting in 100 houses on the Blakelaw estate (£3,459).—T. Michelson (Electrical). Fifty trolley-buses (£257,942): British United Traction (20 chassis at £48,649), Sunbeam Commercial Vehicles (30 chassis at £76,043), Northern Coachbuilders (30 bodies at £77,850), and Metropolitan Cammell Weymann Motor Bodies (20 bodies at £55,400).

Warwickshire.—Buildings Committee. Accepted. Automatic telephone extensions at Shire Hall (£661).—Reliance Telephone Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Two infant schools; J. A. O. Allan, Ross & Allan, architects, 10, Bon-Accord Square.

Battersea.—Cinema on site of former Lavender Hill pavilion, for the Gaumont-British Picture Corporation; W. E. Trent, architect, 123, Regent Street, W.1.

Belford.—Houses (20) for the R.D.C.; Thomas B. Gregory & Sons, builders, Seahouses, Northumberland.

Billinge and Winstanley.—Houses (150); surveyor, Council Offices, Billinge, near Wigan.

Birkenhead.—Primary school, Bedford Drive; borough engineer.

Bishop's Stortford.—Houses (120), Havers Lane; surveyor, U.D.C. Offices.

Blackpool.—Houses (40), Grange estate; Atherton Bros. (Blackpool), Ltd., builders, Peter Street.

Blyth.—Yacht building and engineering yard; North-East Yacht Building and Engineering Co., Bamburgh, Northumberland.

Boldon (Co. Durham).—Houses (20), Sunniside Lane; U.D.C. surveyor, East Boldon.

Bridlington.—Houses (38), Fortyfoot and Sewerby Road corner; borough engineer.

Camborne.—Factory, Tincroft Mine, Carn Brea,; John Heathcote & Co., lace manufacturers, Tiverton.

Cambridgeshire.—Maternity block at the County Hospital (£11,500); county architect, Shire Hall, Cambridge.

Cardiff.—Radio therapy department at the Royal Infirmary, for the South Wales and Monmouthshire Joint Cancer Committee; H. W. Fletcher, architect, 21, Dumfries Place.

Chanctonbury.—Houses (30), The Moat, Pulborough, for R.D.C.; surveyor, Council Offices, Storrington, Sussex.

Crook and Willington.—Houses (112) for the U.D.C.; R. G. Finlay Ltd., builders, West Sunniside, Sunderland.

Durham.—Permanent houses (56); city engineer, Durham.

Esher.—Libraries at Esher, Molesey, The Dittons and Cobham (£60,950); surveyor, U.D.C. Offices.

Gateshead.—Houses (106), Coach Road estate; J. Clark (New Seaham), Ltd., builders, Seaham, Co. Durham.

Factory for the Heaton Foundry Co., Ltd., Team Valley; W. Wigham & Sons, Hylton, Sunderland.

Hartlepool.—Five factories, trading estate; F. Shepherd & Son, builders, York.

Hertfordshire.—Staff houses (36), opposite Cell Barnes Colony (£52,000); county architect, Castle Street, Hertford.

Jarrow.—Asphalt works, for the Neuchatel Asphalte Co., Ltd.; D. Glen, builder, Back Queen's Road.

Factory, Bede estate; Newrick & Blackbell, architects, 24 John Street, Sunderland.

Kent.—Homes for old people, Dover (£17,320) and fourteen schools of light construction; county architect, Maidstone.

Keswick.—Factory additions, Southey Mill; Cumberland Pencil Co. (£35,000).

Leicestershire.—Adapting Maplewell Hall, Loughborough, as students' hostel (£12,500); Leicestershire county architect.

Lewisham.—Four blocks of flats (£298,000); A. Roberts & Co., Ltd., builders, Bermondsey.

Luton.—Flats (240); borough surveyor.

Maryport.—Extensions to factory for Hornflowa, Ltd., Solway estate.

Morley.—Houses (66), Fairfax Avenue (£70,000); borough engineer.

Newburn-on-Tyne.—Houses (360), Lemington and West Denton; surveyor, U.D.C. Offices.

Newcastle-on-Tyne.—Houses (156), Benton Lodge estate; city architect, 18, Cloth Market.

Houses (21), in flats, Brenda Avenue; Hadden and Hillman, builders, New Bridge Street.

Newport (I.o.W.).—Houses (86), Marbourne Park estate; A. E. Jukes & Son, Ltd., Southampton.

Perth.—School (£60,000); architect, County Council.

Salterbeck (Cumberland).—Factory for Cumbrian Tools, Ltd.; West Cumberland Industrial Development Co., Ltd., Whitehaven.

Spennymoor.—Factory, for Thomas Summerson & Sons, railway plant makers; H. E. Pitt, Ltd., builders, Leopold Street, Millfield, Sunderland.

Stockton-on-Tees.—Factory, for G. Turner & Co., Ltd., Brighouse; N. Stonehouse, builder, Bridge Road.

Sunderland.—Factory, Low Row; Newrick & Blackbell, architects, 24, John Street.

Factory, Catherine Street for R. Powley & Sons, Ltd.; W. & T. R. Milburn, architects, 17, Fawcett Street.

Schools, Hill View estate, for the E.C.; education architect, John Street.

Surrey.—Modernization and re-equipment of main kitchen at Netherne Hospital, Hooley, including X-ray plant (£18,600); county architect, Kingston-on-Thames.

Tynemouth.—Houses (16), East End "A" site; borough engineer, 19, Howard Street, North Shields.

Walsall.—Houses (200), Dudley Fields and Rock Lane estates (£251,000); G. Wimpey & Co., Ltd., & G. Calverley & Sons, Ltd.

Warrenpoint (Co. Down).—New factory for Corrugated Containers, Ltd.

Wellingborough.—Extensions, Park Hospital (£37,000); Northants county architect.

West Hartlepool.—Houses (100), Rift House Estate, Kendal Road and Patterdale Street; Nox, Ltd., builders, 55, Old Bond Street, London.

Whitehaven.—Factory for Eugene, Ltd., Hensingham.

Workington.—Factory for D. S. Plugs, Ltd., Salterbeck.

Factory for Vale Carpet Co., Ltd., Salterbeck.

Export Inquiries

WE have received the undermentioned inquiries from firms and individuals overseas who wish to secure agencies for British electrical equipment and appliances or to import them into their territories. We shall be glad to pass on to them replies received from readers which should be addressed to the Editors, quoting the number given in parentheses. We cannot vouch for the standing of inquirers and manufacturers replying to them will no doubt require the usual references:—

India.—A Punjab concern wishes to purchase British electrical accessories, appliances, lamps, fans, torches, etc. (X.166.)

Somaliland.—A firm at Kismayu desires to get into touch with British wholesalers for the purchase of a wide range of electrical materials and accessories, wires, lamps and batteries. (X.167.)

China.—United Kingdom buying agents for a large Chinese industrial group wish to get into touch with British manufacturers of radio sets and refrigerators. (X.168.)